هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

اعتماد
NCAAA
T4
2020

Course Specifications

Course Title:	Electronics 1
Course Code:	**311PHYS-3**
Program:	**Physics**
Department:	**Physics**
College:	**Science**
Institution:	**Jazan University**

Table of Contents

A. Course Identification

1. Credit hours:							
2. Course type							
a.	University	☐	College	☐	Department	√	Others ☐
b.	Required	√	Elective	☐			
3. Level/year at which this course is offered: Level 5/ Year 3							
4. Pre-requisites for this course (if any)**: 231 PHYS-4**							
5. Co-requisites for this course (if any)**: NIL**							

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	36	80%
2	Blended	9	20%
3	E-learning		
4	Distance learning		
5	Other		

7. Contact Hours (based on academic semester)

No	Activity	Contact Hours
1	Lecture	42
2	Laboratory/Studio	
3	Tutorial	3
4	**Others** (specify)	
	Total	**45**

B. Course Objectives and Learning Outcomes

1. Course Description

This course provides fundamental knowledge in electronic aspects including resistors, capacitors, and inductors with direct current (DC) and alternating current (AC) sources, the analysis of circuits and semiconductor devices. The course covers basic electronic components, DC circuits, AC circuits, Kirchhoff's law, transient response of RL, RC and RLC circuits, properties of semiconductor materials, p-n junctions, diodes and their applications in rectifiers, filters, and multiplier circuits, and basic structure and configurations of bipolar junction transistors (BJT).

2. Course Main Objective

This course is designed to provide students with:

- Principles and circuit analysis of direct current (DC) and alternating current (AC) electrical circuits.
- Basic properties and characteristics of semiconductor materials and devices.
- Various types of diodes and their applications.
- Structures, operational principles, modes and characteristics of bipolar junction transistor (BJT).
- Basic principles of electrical test equipment and troubleshooting of components and devices.

3. Course Learning Outcomes

	CLOs	Aligned PLOs
1	**Knowledge and Understanding**	
1.1	**Identify** the symbols, different parameters and working conditions of the electric and electronic devices included in the course description.	**PLO1.1**
1.2	**Define** the basic terms of D.C. current, A.C current, semiconductor, band gaps, pn junctions, different diodes and BJT transistors.	**PLO1.1**
1.3	**Describe** direct current (DC) and alternating current (AC) circuits and their parameters, metals semiconductors and insulators, band gaps of different materials, different types of semiconductors and their configurations, PN junctions, different types of diodes constructions biases and applications, rectifiers and filters, BJT transistors types, constructions, characteristics and their applications.	**PLO1.2**
2	**Skills :**	
2.1	**Solve** problems related to D.C and A.C electrical circuits, different types of diodes and BJT transistor analysis.	**PLO2.1**
2.2	**Derive** Different relations of D.C circuits, RL, RC and RLC circuits, Power in A.C and D.C circuits, relations of different types of diodes and rectifiers circuits, and BJT transistor circuits.	**PLO2.2**
2.3	**Develop** critical thinking competencies on the analysis of different electrical and electronics circuits.	**PLO2.4**
2.4	**Demonstrate** communication skills during interactive discussion, group assignments, essays or web-based activities, self-learning awareness	**PLO2.4**
3	**Values:**	
3.1	**Show** effective collaboration and bear individual responsibility during group work and/or assignments.	**PLO3.1**

C. Course Content

No	List of Topics	Contact Hours
1	Direct current (DC) circuits: electromotive force (emf) ,Internal resistances, electronic components in DC source, series circuits, parallel circuit, power, Kirchhoff's laws, R.C circuit (charging and discharging).	9
2	Alternating current(AC) circuits: AC source, resistors in AC circuit , inductors in AC circuit, capacitors in AC circuit.	3
3	The RLC A circuits: RLC series circuits, Phasor diagram, Resonance frequency, Rectifiers and filters, Power in AC circuit, Transformer and power transmission.	6
4	Electronic structure of atoms, atom model, atomic number and electron shells.	3
5	Properties of semiconductor materials: Category of solid materials, semiconductors, covalent bond, Conduction in semiconductors, P-type and N-type semiconductors.	3
6	P-N junctions: Depletion region, Barrier potential, Energy diagram and depletion region.	3
7	The diodes: The physics of diodes, biasing of a diode, characteristics of a diode, diode models, testing a diode.	3
8	Application of diodes: Diode as a rectifier (half wave and full wave	3

	rectifier) Power supply filters and regulators, diode data sheet.	
9	Special purpose of diodes: Zener diodes and applications, varactor diode, light emitting diodes (LED), Photodiodes, Laser diodes, current regulated diodes, PIN diode, metal semiconductor diode and tunnel diode.	6
10	Bipolar junction transistors (BJTs): Transistor structure and symbol, transistor currents, operation modes, circuit analysis, transistor characteristics , BJT applications.	3
11	Review	3
Total		45

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge and Understanding**		
1.1	**Identify** the symbols, different parameters and working conditions of the electric and electronic devices included in the course description.	Lectures, blackboard and visualization, group and interactive guided discussion, Interactive discussion	**Direct** (formative and summative): In class interactive questioning, quizzes, written exams **Indirect**: student survey
1.2	**Define** the basic terms of D.C. current, A.C current, semiconductor, band gaps, pn junctions, different diodes and BJT transistors.	Lectures, blackboard and visualization, group and interactive guided discussion, Interactive discussion	**Direct** (formative and summative): In class interactive questioning, quizzes, written exams **Indirect**: student survey
1.3	**Describe** direct current (DC) and alternating current (AC) circuits and their parameters, metals semiconductors and insulators, band gaps of different materials, different types of semiconductors and their configurations, PN junctions, different types of diodes constructions biases and applications, rectifiers and filters, BJT transistors types, constructions, characteristics and their applications.	Lectures, blackboard and diagram illustration, group discussion, Interactive illustrations-Student contribution	**Direct** (formative and summative): In class interactive questioning, quizzes, written exams **Indirect:** student survey
2.0	**Skills**		
2.1	**Solve** problems related to D.C and A.C electrical circuits, different types of diodes and BJT transistor analysis.	Lectures, blackboard and visualization, brain storming, group and interactive discussion, Interactive illustration – Problem based learning	**Direct** (formative and summative): In class interactive questioning, quizzes, written exams **Indirect**: student survey

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
2.2	**Derive** Different relations of D.C circuits, RL, RC and RLC circuits, Power in A.C and D.C circuits, relations of different types of diodes and rectifiers circuits, and BJT transistor circuits.	Lectures, blackboard and visualization, brain storming, group and interactive discussion, Interactive illustration – Problem based learning	**Direct** (formative and summative): In class interactive questioning, quizzes, written exams **Indirect**: student survey
2.3	**Develop** critical thinking competencies on the analysis of different electrical and electronics circuits.	Lectures, blackboard and visualization, brain storming, group and interactive discussion, Interactive illustration – Problem based learning	**Direct** (formative and summative): In class interactive questioning, quizzes, written exams **Indirect:** student survey
2.4	**Demonstrate** communication skills during interactive discussion, group assignments, essays or web-based activities, self-learning awareness	Lectures, blackboard and visualization, brain storming, group and interactive discussion, Interactive illustration – Problem based learning	**Direct** (formative and summative): In class interactive questioning, quizzes, written exams **Indirect:** student survey
3.0	**Values**		
3.1	**Show** effective collaboration and bear individual responsibility during group work and/or assignments.	Interactive and Group discussion, expository and discovery teaching	**Direct** (formative and summative): interactive questioning- group assignment **Indirect**: student survey

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Homework assignment- Contribution in interactive discussion- Group work or Project	**3**	**3** (3%)
2	Lecture Quiz 1	**4**	**5** (5%)
3	First Mid-term exam	**6**	**15** (15%)
4	Homework assignment- Contribution in interactive discussion- Group work or Project	**10**	**3** (3%)
5	Lecture Quiz 2	**11**	**5** (5%)
6	Second mid-term exam	**12**	**15** (15%)
7	Homework assignment- Contribution in interactive discussion- Group work-essay or Project discussion	**11**	**4** (4%)
8	Final Exam	**16**	**50** (50%)

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student

consultations and academic advice : Each group of students is assigned to a staff member who will be available for help and academic guidance office hours at specific 2hours on daily basis

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	• College Physics, Raymond A. Serway, Jerry S. Faughn, Chris Vuille; Brooks/Cole, 9th Edition 2009. • Thomas L. Floyd, Electronic Devices, Pearson Prentice Hall, Inc., 7th Edition, 2005.
Essential References Materials	• James W. Nilsson and Susan Riedel, Electric Circuits, Addison-Wesely Publishing Company Inc., 2007. • Electronics: Circuits and Devices; Ralph J. Smith, John-Willey and Sons, Inc., • 3rd Edition, 1987. • Basic Electronics for Scientists; James J. Brophy, McGraw-Hill Kogakusha 1990.
Electronic Materials	http://freevideolectures.com/Subject/Electronics# http://www.electronics-tutorials.ws/
Other Learning Materials	Workbench electronics circuit software.

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	Class room- if possible room for interactive discussion (round table)
Technology Resources (AV, data show, Smart Board, software, etc.)	Data show- smart board
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	none

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of teaching	Students, Peer and program leader	Indirect (CES)- Indirect peer evaluation
Assessment	Students, Program assessment committee	Direct/ Indirect
Extent of achievement of course learning outcomes	Instructor	Direct/Indirect
Quality of learning resources	Students, Faculty members	Indirect

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)
Evaluators (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

H. Specification Approval Data

Council / Committee	Department council
Reference No.	8
Date	16/4/1442

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

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2020

Course Specifications

Course Title:	Physical Optics
Course Code:	**312PHYS**
Program:	**Physics**
Department:	**Physics**
College:	**Science**
Institution:	**Jazan University**

Table of Contents

A. Course Identification

1. Credit hours: 4									
2. Course type									
a.	University	☐	College	☐	Department	v	Others	☐	
b.	Required	v	Elective	☐					
3. Level/year at which this course is offered: Level5/Year3									
4. Pre-requisites for this course (if any)**:211PHYS (Geometrical Optics)**									
5. Co-requisites for this course (if any)**:NIL**									

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	42	55%
2	Blended	6	7%
3	E-learning		
4	Distance learning		
5	Other (lab)	27	37%

7. Contact Hours (based on academic semester)

No	Activity	Contact Hours
1	Lecture	45
2	Laboratory/Studio	30
3	Tutorial	--
4	**Others** (specify)	--
	Total	75

B. Course Objectives and Learning Outcomes

1. Course Description

The course provides background knowledge of several optics phenomena with an emphasis on the light as electromagnetic waves. It covers the concepts of superposition, interference, diffraction and polarization of light. The course also covers applications and experiments related to these concepts. The course material will be covered in traditional lecture format as well as laboratory demonstrations and hands-on activities.

2. Course Main Objective

The concept of the nature of light and wave theory of light.
- The concept of superposition of light
- The interference of light and related experiments.
- The principles of the diffraction of light for many cases and diffraction grating.
- The principles of polarization of light.
- Hands on experience in the laboratory experiments to understand the related concepts

3. Course Learning Outcomes

	CLOs	Aligned PLOs
1	**Knowledge and Understanding**	
1.1	**Recall** the superposition of waves, the wave velocity, and the group velocity, difference between interference and diffraction and their types as well as the light polarization and its various methods	**PLO1.1**
1.2	**Define** the concepts of Huygens's principle, interference and diffraction of light, superposition of waves, and its applications, and calculate the aspects of the polarization of light, the birefringence, the Brewster's angle and polarization by reflection	**PLO1.1**
1.3	**Discuss** various types of interference, various types of diffraction as well as various types of polarization	**PLO1.2**
2	**Skills :**	
2.1	**Solve** various problems related to interference and diffraction such as the film thickness by interference and conditions of maxima and minima for interference in films, fringes of equal thickness Newton's Rings, and Michelson interferometer, double slit interference, and single, double and multi slit diffraction	**PLO2.1**
2.2	**Derive** the expression for irradiance of light for double slit interference, single, double and multi slit diffraction.	**PLO2.2**
2.3	**Perform experiments** about interference in Young's double slit, diffraction from single and double slit, and hair, thickness, Newton's Rings, Michelson interferometer, and Malus' law of polarization, Optical activity and polarization and analyze their related data	**PLO2.3**
2.4	**Develop** competencies in critical thinking, communication and writing lab reports.	**PLO2.4**
3	**Values:**	
3.1	**Demonstrate** abilities to work in groups and bear individual responsibility during lab work, interactive discussion and group assignments.	**PLO3.1**
3.2	**Show** awareness of safety for own and others when dealing with lab equipment's	**PLO3.3**
3.3		
3...		

C. Course Content

Theoretical Part

No	List of Topics	Contact Hours
1	**Nature of light and wave theory of light** - Concept of light as a particle - Concept of light as a wave - Concept of light as an electromagnetic wave	4
2	**Vibrations and waves** - Simple harmonic motion (SHM) - Transverse wave - Wave velocity	**4**
3	**Superposition of waves** - Addition of SHM - Superposition of two waves - Superposition of many waves - Group velocity	**6**

4	**Interference of light** - Huygens' principle - Young's experiment - Thin film interference - Film thickness by interference - Newton's ring - Others interferometers apparatuses	**12**
5	**Diffraction of light** - Single slit diffraction - Resolving power - Diffraction grating - Rayleigh's criterion - Fraunhofer diffraction - Double slit diffraction - Diffraction from many slits - Diffraction grating - Fresnel diffraction	**10**
6	**Polarization of light** - State of polarization and polarizer - Malus' law - Dichroism - Birefringence - Brewster's angle - Polarization by reflection	**6**
7	**Review**	**3**
	Total	**45**

Experimental Part:

No	List of Topics	Contact Hours
1	**Interference of light using Young's double-slit**	**2**
2	**Diffraction of light through a single-slit**	**2**
3	**Diffraction grating spectrometer**	**2**
4	**The diameter of a Human Hair by Laser Diffraction**	**2**
5	**Michelson interferometer**	**2**
6	**Newton's interference rings**	**2**
7	**Malus' law of polarization**	**2**
8	**Optical activity and polarization**	**2**
9	**Brewster's angle**	**2**
10	**Kerr effect**	**2**
	Introduction, review, and various exams	**10**
	Total	**30**

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge and Understanding**		
1.1	**Recall** the superposition of waves, the wave velocity, and the group velocity, difference between interference and diffraction and their types as well as the light polarization and its various methods	Lectures, blackboard and visualization, group and interactive guided discussion, Interactive discussion	**Direct** (formative and summative): In class interactive questioning, quizzes, written exams **Indirect**: student survey
1.2	**Define** the concepts of Huygens's principle, interference and diffraction of light, superposition of waves, and its applications, and calculate the aspects of the polarization of light, the birefringence, the Brewster's angle and polarization by reflection	Lectures, blackboard and diagram illustration, group discussion, Interactive illustrations- Student contribution	**Direct** (formative and summative): In class interactive questioning, quizzes, written exams **Indirect:** student survey
1.3	**Discuss** various types of interference, various types of diffraction as well as various types of polarization	Lectures, blackboard and visualization, brain storming, group and interactive discussion, Interactive illustration – Problem based learning	**Direct** (formative and summative): In class interactive questioning, quizzes, written exams **Indirect**: student survey
2.0	**Skills**		
2.1	**Solve** various problems related to interference and diffraction such as the film thickness by interference and conditions of maxima and minima for interference in films, fringes of equal thickness Newton's Rings, and Michelson interferometer, double slit interference, and single, double and multi slit diffraction	Lectures, blackboard and visualization, brain storming, group and interactive discussion, Interactive illustration – Problem based learning	**Direct** (formative and summative): In class interactive questioning, quizzes, written exams **Indirect**: student survey
2.2	**Derive** the expression for irradiance of light for double slit interference, single, double and multi slit diffraction.	Lectures, blackboard and visualization, brain storming, group and interactive discussion, Interactive illustration – Problem based learning	**Direct** (formative and summative): In class interactive questioning, quizzes, written exams **Indirect**: student survey
2.3	**Perform experiments** about interference in Young's double slit, diffraction from single and double slit, and hair, thickness, Newton's Rings, Michelson interferometer, and Malus' law of polarization, Optical activity and polarization and analyze their related data	Hands on lab demonstrations- guided discussion – guided discovery	**Direct** (formative and summative):Evaluation of assignments, Step-by-step checkpoint assessment of experiment, In lab

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
			interactive questioning, quizzes, written exams **Indirect:** student survey
2.4	**Develop** competencies in critical thinking, communication and writing lab reports.	Lectures, blackboard and visualization, brain storming, group and interactive discussion, Interactive illustration – Problem based learning	**Direct** (formative and summative): In class interactive questioning, quizzes, written exams **Indirect:** student survey
3.0	**Values**		
3.1	**Demonstrate** abilities to work in groups and bear individual responsibility during lab work, interactive discussion and group assignments.	Interactive and Group discussion, expository and discovery teaching	**Direct** (formative and summative): In lab interactive questioning **Indirect**: student survey
3.2	**Show** awareness of safety for own and others when dealing with lab equipment's	Case study-interactive demonstration-guided discussion	**Direct** (formative and summative): In lab interactive questioning **Indirect**: student survey
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2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	**Homework assignment- Contribution in interactive discussion**	**2**	**2 (2%)**
2	**Quiz 1**	**3**	**2 (2%)**
3	**First Mid-term exam**	**7**	**10 (10%)**
4	**Homework assignment- Contribution in interactive discussion**	**8**	**2 (2%)**
5	**Quiz 2**	**9**	**2 (2%)**
6	**Second mid-term exam**	**11**	**10 (10%)**
7	**Homework assignment- Contribution in interactive discussion- Group work-essay or Project discussion**	**12**	**2 (2%)**
8	**Laboratory Exam**	**14**	**20 (20%)**
9	**Final Exam**	**16**	**50 (50%)**

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice : **Each group of students is assigned to a staff member who will be available for help and academic guidance office hours at specific 2h on daily basis.**

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	Introduction to Optics by Frank L Pedrotti, Leno M Pedrotti , Leno S Pedrotti . Addison-Wesley; 3rd edition (April 17, 2006).
Essential References Materials	Fundamental of Optics; F. A. Jenkins and H. S. White, McGraw-Hill Priml Custom Publishing, 2001. - Optics; Eugene Hecht, 4th Edition, Addison- Wesley, 2001.
Electronic Materials	**http://www.wikipedia.org/** **https://spie.org/** **http://hyperphysics.phy-astr.gsu.edu/**
Other Learning Materials	

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	**1 Lecture room(s) for groups of 50 students.** **- 1 Laboratory for group of 25 students.**
Technology Resources (AV, data show, Smart Board, software, etc.)	Data show- smart board
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	None

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of teaching	Students, Peer and program leader	Indirect (CES)- Indirect peer evaluation
Assessment	Students, Program assessment committee	Direct/ Indirect
Extent of achievement of course learning outcomes	Instructor	Direct/Indirect
Quality of learning resources	Students, Faculty members	Indirect
Effectiveness of teaching	Students, Peer and program leader	Indirect (CES)- Indirect peer evaluation

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)
Evaluators (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

H. Specification Approval Data

Council / Committee	**Department council**
Reference No.	**8**
Date	**16/4/1442**

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

اعتماد NCAAA T4 2020

Course Specifications

Course Title:	Electrodynamics
Course Code:	**331PHYS**
Program:	**Physics**
Department:	**Physics**
College:	**Science**
Institution:	**Jazan University**

Table of Contents

A. Course Identification

1. Credit hours: 3							
2. Course type							
a.	University	☐	College	☐	Department	√	Others ☐
b.	Required	√	Elective	☐			
3. Level/year at which this course is offered: Level 5/ Year 3							
4. Pre-requisites for this course (if any)**:231 PHYS**							
5. Co-requisites for this course (if any)**: NIL**							

6. Mode of Instruction (mark all that apply)

Percentage	Contact Hours	Mode of Instruction	No
84%	38	Traditional classroom	1
16%	7	Blended	2
		E-learning	3
		Correspondence	4
		Other	5

7. Contact Hours (based on academic semester)

No	Activity	Contact Hours
1	Lecture	42
2	Laboratory/Studio	--
3	Tutorial	3
4	**Others** (specify)	
	Total	45

B. Course Objectives and Learning Outcomes

1. Course Description

This course discusses the electric phenomena when the charge is assumed to be at rest (electrostatics), magnetic phenomena under steady state current consideration (magnetostatics) and some special techniques. The course mainly focuses on establishing the notion of electrodynamics based on the time and spatial dependence of the electric and magnetic fields. It also encompasses Maxwell's equations and derivation of electromagnetic wave equation for vacuum and material medium.

2. Course Main Objective

This course is designed to provide the students with:

1. The mathematics of vector operations, vector calculus, and the curvilinear coordinates
2. The fundamental background and the foundation of electrodynamics.
3. Problem-solving skills to calculate the electric and magnetic fields as well as the electrostatic problems using special techniques

4. a depth understanding to electrostatics and magneticstatics concept,
5. The experimental and theoretical origin of Maxwell's equations
6. Mathematical techniques to derive and solve the wave equation
7. Knowledge with the fundamental properties of the electromagnetic wave propagation in vacuum and different medium.

3. Course Learning Outcomes

	CLOs	Aligned PLOs
1	**Knowledge and Understanding**	
1.1	**Describe:** the electric field of different charge distributions, the electric flux, electric potential of localized charge distributions and in term of electric field, the magnetic force, the current, the electromotive force, the magnetic flux, and the induced electric field,. the electromagnetic wave parameters	**PLO1.1**
1.2	**State**: the summary of electrostatic boundary conditions, the work and energy of point and continuous charge distributions, the comparison between electrostatic and magnetostatic, Maxwell's equations in differential and integral form	**PLO1.2**
1.3	**Discus** The properties of the electric field lines, the properties of the magnetic field, the properties of the monochromatic plane wave solution in vacuum , how Faraday fixed electrostatics laws and how Maxwell fixed Ampere law	**PLO1,2**
2	**Skills :**	
2.1	**Apply** the fundamental theorem of differential and integral calculus in electrodynamics, Gauss's law to calculate the electric field, method of images to determine the induced charge surface, Biot-Savart and Amperes' law to find the magnetic field .	**PLO2.1**
2.2	**Derive** Gauss's law in differential and integral form, Poisson and Laplace' equations, the continuity equation of charge, Faraday's Law of induction, Ampere's law, the wave equation in different media	**PLO2.2**
2.3	**Solve** the wave equation in vacuum and material	**PLO2.1**
2.4	**Develop** communication and critical thinking competencies during interactive discussion, group assignments, essays or web-based activities	**PLO2.4**
3	**Values:**	
3.1	**Develop** skills of working in groups in group assignments and discussion and bear individual responsibility in the assigned tasks	**PLO3.1**

C. Course Content

Contact Hours	List of Topics	No
HOURS 9	**1. Vector analysis** 1.1 Vector Algebra**:** vector operations, component form, triple product, position vector and displacement 1.2 Differential calculus: gradient, del operator, divergence, curl. Second derivatives with examples. 1.3 Integral calculus: Line, surface and volume integrals. The fundamental theorem of calculus, the fundamental theorem for gradients, the fundamental theorem for divergences, the fundamental theorem for curls.	1

	1.4. Curvilinear Coordinates: spherical polar and cylindrical coordinates	
HOURS 9	**2. Electrostatics** 2.1 The electric field. 2.2 Divergence and curl of electrostatic fields. 2.3 Electric potential. 2.4 Work and energy in electrostatics.	2
HOURS 6	**3. Special techniques** 3.1. Laplace equation 3.2. The Method of Images	3
HOURS 9	**4. Magnetostatics** 4.1 Lorentz force law: magnetic fields, magnetic forces, currents 4.2 The Biot-Savart law: steady current, magnetic field of steady current 4.3 Divergence and curl of B: Application of Ampere's law, Comparison of magnetostatics and electrostatics.	4
HOURS 6	**5. Electrodynamics** 5.1 Electromotive force: Ohm' law. Electromotive force, emotional electromotive force. 5.2 Electromagnetic induction: Faraday's law. Section, the induced electric field 5.3 Maxwell equations. Electrodynamics before Maxwell, Fix Maxwell's equations, Maxwell's equation.	5
HOURS 6	**6. Electromagnetic waves** 6.1 Waves in one dimension: the wave equation, sinusoidal waves, polarization. 6.2 Electromagnetic waves in vacuum: The wave equation of E and B, monochromatic plane waves, energy and momentum in electromagnetic waves.	6
45	**Total**	

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge and Understanding**		
1.1	**Describe:** the electric field of different charge distributions, the electric flux, electric potential of localized charge distributions and in term of electric field, the magnetic force, the current, the electromotive force, the magnetic flux, and the induced electric field, . the electromagnetic wave parameters	Lectures, discussion comparisons	**Direct** (formative and summative): In class interactive questioning, quizzes, written exams **Indirect:** student survey
1.2	**State**: the summary of electrostatic boundary conditions, the work and energy of point and continuous charge	Lectures, discussion	**Direct** (formative and summative): In class interactive questioning,

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
	distributions, the comparison between electrostatic and magnetostatic, Maxwell's equations in differential and integral form		quizzes, written exams **Indirect:** student survey
1.3	**discus** The properties of the electric field lines, the properties of the magnetic field, the properties of the monochromatic plane wave propagation in vacuum	Lectures, discussion	**Direct** (formative and summative): In class interactive questioning, quizzes, written exams **Indirect:** student survey
2.0	**Skills**		
2.1	**Apply** the fundamental theorem of differential and integral calculus in electrodynamics, Gauss's law to calculate the electric field, method of images to determine the induced charge surface, Biot-Savart and Amperes' law to find the magnetic field .	Lectures, discussion	**Direct** (formative and summative): In class interactive questioning, quizzes, written exams **Indirect:** student survey
2.2	**Derive** Gauss's law in differential and integral form, Poisson and Laplace' equations, the continuity equation of charge, Faraday's Law of induction, Ampere's law, the wave equation in different media	Lectures, discussion, Tutorial	**Direct** (formative and summative): In class interactive questioning, quizzes, written exams **Indirect:** student survey
2.3	**Solve** the wave equation in vacuum and material	Lectures, Discussion, Tutorial	**Direct** (formative and summative): In class interactive questioning, quizzes, written exams **Indirect:** student survey
2.4	**Develop** communication and critical thinking competencies during interactive discussion, group assignments, essays or web-based activities	Lectures, Discussion, Tutorial	**Direct** (formative and summative): In class interactive questioning, quizzes, written exams **Indirect:** student survey
3.0	**Values**		
3.1	**Develop** skills of working in groups in group assignments and discussion and bear individual responsibility in the assigned tasks	Discussion, question and answer	**Direct** In class interactive questioning, quizzes, written exams **Indirect:** student survey

2. Assessment Tasks for Students

Percentage of Total Assessment Score	Week Due	*Assessment task	#
2.5 (2.5%)	**3**	**Assignment 1**	**1**
2.5 (2.5%)	**6**	**Assignment 2**	**2**
5 (5 %)	**7**	**Quiz I**	**3**
15 (15%)	**8**	**First Mid-term exam**	**4**
2.5 (2.5%)	**11**	**Assignment 3**	**5**
2.5 (2.5%)	**13**	**Assignment 4**	**6**
5 (5%)	**14**	**Quiz II**	**7**

Percentage of Total Assessment Score	Week Due	*Assessment task	#
15 (15%)	**14**	**Second mid-term exam**	**8**
50 (50%)	**16**	**Final Exam**	**9**

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice :

Each group of students is assigned to a staff member who will be available for help and academic guidance office hours at specific 2hr on daily basis.

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	Introduction to Electrodynamics, 3rd Edition, Dived J. Griffiths, Prentice-Hall-, Inc., Englewood Cliffs, 1991
Essential References Materials	- Foundations of Electromagnetic Theory, 4th Edition, John R. Reitz, Frederick J. Milford, Robert W. Christy, Addison-Wesley Publishing Company, Inc., 2008
Electronic Materials	• *e-Learning* in the School of *Physics* and Astronomy *(www.ph.ed.ac.uk/elearning)* • Physical Sciences Resource Center (PSRC) (www.psrc-online.org*)* • The Physics Homepage *(www.physics.ox.ac.uk)*
Other Learning Materials	• Mathematical packages: *Mathematica*, Math Lab, and Maple. • Software: Virtual Physics

2. Facilities Required

Resources	Item
Class room	**Accommodation** Classrooms, laboratories, demonstration) (.rooms/labs, etc
Data show- smart boar	**Technology Resources** AV, data show, Smart Board, software,) (.etc
None	**Other Resources** Specify, e.g. if specific laboratory) equipment is required, list requirements or (attach a list

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of teaching	Students, Peer and program leader	Indirect (CES)- Indirect peer evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Assessment	Students, Program assessment committee	Direct/ Indirect
Extent of achievement of course learning outcomes	Instructor	Direct/Indirect
Quality of learning resources	Students, Faculty members	Indirect

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)
Evaluators (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

H. Specification Approval Data

Council / Committee	Department council
Reference No.	8
Date	16/4/1442

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

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Course Specifications

Course Title:	**Modern Physics 1**
Course Code:	**341Phys**
Program:	**Physics**
Department:	**Physics**
College:	**Science**
Institution:	**Jazan University**

Table of Contents

A. Course Identification

1. Credit hours:	
2. Course type **a.** University ☐ College ☐ Department ☒ Others ☐ **b.** Required ☒ Elective ☐	
3. Level/year at which this course is offered:	**Level 5/ Year 3**
4. Pre-requisites for this course (if any)**: Nil**	
5. Co-requisites for this course (if any)**: Nil**	

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	40	89%
2	Blended	5	11%
3	E-learning		
4	Distance learning		
5	Other		

7. Contact Hours (based on academic semester)

No	Activity	Contact Hours
1	Lecture	42
2	Laboratory/Studio	--
3	Tutorial	3
4	Others (specify)	
	Total	45

B. Course Objectives and Learning Outcomes

1. Course Description

This course involves the extremes of very small distances and velocities close to the speed of light. These extremes demanded new theories in the early part of the 20th century and yielded the weird and wonderful results of Einstein's relativity theory and Schrodinger's equation in quantum mechanics. The course covers the birth of modern physics before launching into Einstein's theory of special relativity, and introducing quantum mechanics for the description of atomic physics.

2. Course Main Objective

This course is designed to provide students with:

- The changes in physics that took place near the end of 19^{th} century.
- Special Theory of Relativity.
- Experimental Basis of Quantum Physics.
- Solve problems related to the main physical concepts and theories of the 20_{th} century.
- Structure of the Atom and Wave Properties of Matter.

3. Course Learning Outcomes

	CLOs	Aligned PLOs
1	**Knowledge and Understanding**	
1.1	**Define** the major 20th century developments in Physics, Doppler effect, blackbody, invariant quantity, Compton effect, De Broglie wavelength, Bremsstrahlung process.	**PLO1.1**
1.2	**State** Einstein's postulates of Special Relativity, proposal of nature of light, Maxwell's theory of electromagnetic waves, Galilean transformations, Lorentz transformations, X-ray properties, cathode ray properties, Wien's displacement law, Stefan Boltzmann Law, Duane-Hunt rule, assumption of atom models (Thomson, Rutherford, Bohr), Heisenberg's uncertainly principle	**PLO1.1**
1.3	**Explain** the solution of problems involving time dilation length contraction, relativistic momentum, and relativistic energy.	**PLO1.2**
2	**Skills :**	
2.1	**Solve** various problems related to time dilation length contraction, relativistic momentum, relativistic energy, the photoelectric effect, Compton scattering, Bohr model, Blackbody radiation, De Broglie wavelength and uncertainly principal.	**PLO2.1**
2.2	**Compare** Modern Physics with Classical Physics	**PLO2.2**
2.3	**Evaluate** quantum methods in the solution of problems involving atomic spectra, blackbody radiation, the photoelectric effect, X-ray emission, the structure of the atom, and one dimensional potential	**PLO2.2**
2.4	**Develop** communication and critical thinking competencies during interactive discussion, group assignments, essays or web-based activities	**PLO2.4**
3	**Values:**	
3.1	**Show** effective collaboration and bear individual responsibility during group work and/or assignments	**PLO3.1**

C. Course Content

No	List of Topics	Contact Hours
1	**The Birth of Modern Physics** · Classical Physics of the 1890s · Mechanics, Electromagnetism, Thermodynamics · The Kinetic theory of gases · Waves and Particles · Conversation Laws and Fundamental Forces	**9**
2	**Special Theory of Relativity** · The Michelson-Morley Experiments · Einstein's postulates · The Lorentz Transformation · Time Dilation and Length Contraction · Twin Paradox · Spacetime · Doppler Effect · Relativistic Momentum · Relativistic Energy	**9**

3	**Experimental Basis of Quantum Physics** · Discovery of the X ray and the Electron · Blackbody Radiation · Photoelectric Effect · Experimental results of Photoelectric effect · Classical Interpretation · Quantum Interpretation · X-Ray Production · Compton Effect · Pair Production and Annihilation	**9**
4	**Structure of the Atom** · The Atomic Models of Thomson and Rutherford · The Classical Atom Model · The Bohr Model of the Hydrogen Atom · Success and Failures of the Bohr Model	**6**
5	**Wave Properties of Matter and Quantum Mechanics** · X-Ray Scattering · De Broglie Waves · Wave Motion · Uncertainty principle	**9**
6	**Review**	**3**
Total		

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge and Understanding**		
1.1	**Define** the major 20th century developments in Physics, Doppler effect, blackbody, invariant quantity, Compton effect, De Broglie wavelength, Bremsstrahlung process.	Lectures, discussion, tutorial	Homework, Quizzes, mid-term exams, and final exam
1.2	**State** Einstein's postulates of Special Relativity, proposal of nature of light, Maxwell's theory of electromagnetic waves, Galilean transformations, Lorentz transformations, X-ray properties, cathode ray properties, Wien's displacement law, Stefan Boltzmann Law, Duane-Hunt rule, assumption of atom models (Thomson, Rutherford, Bohr), Heisenberg's uncertainly principle	Lectures, discussion, tutorial	Homework, Quizzes, mid-term exams, and final exam
1.3	**Explain** the solution of problems involving time dilation length contraction, relativistic momentum, and relativistic energy.	Lectures, discussion, tutorial	Homework, Quizzes, mid-term exams, and

			final exam
2.0	**Skills**		
2.1	**Solve** various problems related to time dilation length contraction, relativistic momentum, relativistic energy, the photoelectric effect, Compton scattering, Bohr model, Blackbody radiation, De Broglie wavelength and uncertainly principal.	Lectures, discussion, tutorial	Homework, Quizzes, mid-term exams, and final exam
2.2	**Compare** Modern Physics with Classical Physics	Lectures, discussion, tutorial	Homework, Quizzes, mid-term exams, and final exam
2.3	**Evaluate** quantum methods in the solution of problems involving atomic spectra, blackbody radiation, the photoelectric effect, X-ray emission, the structure of the atom, and one dimensional potential	Lectures, discussion, tutorial	Homework, Quizzes, mid-term exams, and final exam
2.4	**Develop** communication and critical thinking competencies during interactive discussion, group assignments, essays or web-based activities	Interactive discussion-Case study, group project, open discussion - reviews	Brainstorming - Project work, Written reports, Written assignments, presentations
3.0	**Values**		
3.1	**Show** effective collaboration and bear individual responsibility during group work and/or assignments	Individual and group practices-Brain storming – free related small web-based topics	Case study- reports-project work-presentation

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	**Homework assignment**	**2**	**5**
2	**Lecture Quiz 1**	**4**	**5**
3	**Mid-term exam** 1	**6**	**15**
4	**Homework assignment**	**10**	**5**
5	**Lecture Quiz 2**	**11**	**5**
6	**Mid-term exam** 2	**12**	**15**
7	**Final Exam**	**16**	**50**

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice :

Each group of students is assigned to a staff member who will be available for help and academic guidance office hours at specific 2h on daily basis.

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	Modern Physics for Scientists and Engineers, Stephen & Andrew Brooks/Cole, Cengane Learning, 2013.
Essential References Materials	- Modern Physics, P. A. Tipler, and R. A. Llewellyn, Freeman, 4th edition 2002. - Modern Physics; K. S. Krane, Wiley, John & Sons, Inc., 1995. - Concepts of Modern Physics; Arthur Beiser, McGraw-Hill Book Co., 1987.
Electronic Materials	http://ocw.mit.edu/courses/physics/ http://www.physics.org/explore.asp http://www.wikipedia.org/
Other Learning Materials	

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	1 Lecture room(s) for groups of 25 students.
Technology Resources (AV, data show, Smart Board, software, etc.)	Data show- smart board
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of teaching	Students, Peer and program leader	Indirect (CES)- Indirect peer evaluation
Assessment	Students, Program assessment committee	Direct/ Indirect
Extent of achievement of course learning outcomes	Instructor	Direct/Indirect
Quality of learning resources	Students, Faculty members	Indirect
Effectiveness of teaching	Students, Peer and program leader	Indirect (CES)- Indirect peer evaluation

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)
Evaluators (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

H. Specification Approval Data

Council / Committee	**Council of Physics Department**
Reference No.	8

Date	16/4/1442

T4

2020

Course Specifications

Course Title:	**Atomic Physics and Spectroscopy**
Course Code:	**342PHYS**
Program:	**Physics**
Department:	**Physics**
College:	**Science**
Institution:	**Jazan University**

Table of Contents

A. Course Identification

1. Credit Hours: 4							
2. Course type							
a.	University		College		Department	√	Others
b.	Required	√	Elective				
3. Level/year at which this course is offered: Level 6/ Year 3							
4. Pre-requisites for this course (if any)**: 312PHYS**							
5. Co-requisites for this course (if any)**: NIL**							

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	42	56%
2	Blended	5	7%
3	E-learning		
4	Distance learning		
5	Other	28	37%

7. Contact Hours (based on academic semester)

No	Activity	Contact Hours
1	Lecture	45
2	Laboratory/Studio	30
3	Tutorial	--
4	**Others** (specify)	
	Total	75

B. Course Objectives and Learning Outcomes

1. Course Description

The course provides background knowledge of major discoveries and models relating to the atom such as Rutherford model, Bohr model and interpretation of the spectral series of the hydrogen atom, Sommerfeld model, quantum theory achievements (energy levels, Quantum numbers, electron spin and orbital angular momentum, and orbital-spin interaction). The course also covers the rules of atomic emission as well as the effect of magnetic and electric field on the atom. A series of compulsory practical exercises are undertaken to demonstrate the principals involved.

2. Course Main Objective

This course is designed to provide students with the following concepts:

- The fundamental of the atomic structure.
- The essential concepts of orbital motion, spin of the electron and fine structure.
- The effect of magnetic and electric field on the atom
- The spectral line emission and related rules.
- Practical exercises are undertaken.

3. Course Learning Outcomes

	CLOs	Aligned PLOs
1	**Knowledge and Understanding**	
1.1	**State** Rutherford atom model, difficulties of Rutherford model, Bohr postulates, the failure of Bohr model, Quantum numbers, Pauli's exclusion Principle, Selection rule, effect of magnetic field on atom, effect of electric field on atom, factors affecting spectral line broadening, and detection of spectral line.	**PLO1.1**
1.2	**Discuss** Rutherford experiment for atom explanation, and Stern-Gerlach experiment, Electron spin resonance, Normal Zeeman effect, Anomalous Zeeman effect, Paschen Back effect, Stark effect.	**PLO1.2**
2	**Skills :**	
2.1	**Solve** problems related to the wavelengths of spectral lines of different series of hydrogen atom, Rydberg constant, the orbital and spin magnetic moment of an electron, Zeeman splitting, LS coupling, and wavelengths of x-ray lines.	**PLO2.1**
2.2	**Derive** the total energy for hydrogen atom based on Bohr Model, based on Sommerfeld model, radius of different orbit in Bohr atom, velocity of electron in energy levels in Bohr atom, the orbital magnetic moment of an electron for Bohr atom and reveals by quantum mechanics.	**PLO2.2**
2.3	**Perform** laboratory experiments related to atomic physics and spectroscopy	**PLO2.3**
2.4	**Develop** competencies in communication, critical thinking and reporting during lab work.	**PLO2.4**
3	**Values:**	
3.1	**Develop** abilities of team work, bear individual responsibilities on assigned tasks	**PLO3.1**
3.2	**Show** awareness of safety for own and others when dealing with lab equipment's	**PLO3.3**

C. Course Content

Part I: Theory Part:

No	List of Topics	Contact Hours
1	Atom Concept: Rutherford model, Bohr postulates and Bohr model of hydrogen atom, Spectral series of hydrogen atom (Balmer, Lyman, Paschen, Brackett and Pfund), Spectrum of hydrogen like atoms, and Sommerfeld model.	**12**
2	Orbital, Spin and Fine structure: Quantum theory achievements (energy levels - quantum numbers), Magnetic moment of the orbital motion, Spin and magnetic moment of the electron, Stern and Gerlach experiment, Spin-Orbit interaction (LS coupling) and total angular momentum, Fine structure, and Term diagram, Pauli's exclusion principle, Selection Rule, and The Lamb shift.	**12**
3	Atoms in a magnetic and Electric Fields: Electron spin resonance, Normal Zeeman effect Anomalous Zeeman effect , The Paschen Back effect, Stark effect, Factors affecting spectral line broadening (Doppler's width – Stark's width), and Detection of Spectral line.	**12**

4	**X-ray emission and internal shells:** X-ray radiation from outer shells, X-ray Bremsstrahlung spectra, X-ray characteristic radiation.	**6**
5	Review	**3**
	Total	**45**

Part II: Experimental Part:

No	List of Topics	Contact Hours
1	Balmer series of hydrogen and Hg visible spectrum Experiment.	**6**
2	Grating spectrometer (Hg, Na) Experiment.	**8**
3	X–ray Emission Experiment.	**4**
4	Frank–Hertz experiment.	**4**
5	Zeeman effect Experiment.	**4**
7	Review	**4**
	Total	**30**

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge and Understanding**		
1.1	**State** Rutherford atom model, difficulties of Rutherford model, Bohr postulates, the failure of Bohr model, Quantum numbers, Pauli's exclusion Principle, Selection rule, effect of magnetic field on atom, effect of electric field on atom, factors affecting spectral line broadening, and detection of spectral line.	Lectures, blackboard and diagram illustration, group discussion, Interactive illustrations- Student contribution	**Direct** (formative and summative): In class interactive questioning, quizzes, written exams **Indirect:** student survey
1.2	**Discuss** Rutherford experiment for atom explanation, and Stern-Gerlach experiment., Electron spin resonance, Normal Zeeman effect, Anomalous Zeeman effect, Paschen Back effect, Stark effect.	Lectures, blackboard and visualization, brain storming, group and interactive discussion, Interactive illustration – Problem based learning	**Direct** (formative and summative): In class interactive questioning, quizzes, written exams **Indirect**: student survey
2.0	**Skills**		
2.1	**Solve** problems related to the wavelengths of spectral lines of different series of hydrogen atom, Rydberg constant, the orbital and spin magnetic moment of an electron, Zeeman splitting, LS coupling, and wavelengths of x-ray lines.	Lectures, blackboard and visualization, brain storming, group and interactive discussion, Interactive illustration – Problem based learning	**Direct** (formative and summative): In class interactive questioning, quizzes, written exams **Indirect**: student survey
2.2	**Derive** the total energy for hydrogen atom based on Bohr Model, based on	Lectures, blackboard and visualization, brain storming, group and	**Direct** (formative and summative): In class

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
	Sommerfeld model, radius of different orbit in Bohr atom, velocity of electron in energy levels in Bohr atom, the orbital magnetic moment of an electron for Bohr atom and reveals by quantum mechanics.	interactive discussion, Interactive illustration – Problem based learning	interactive questioning, quizzes, written exams **Indirect**: student survey
23	**Perform** laboratory experiments related to atomic physics and spectroscopy	Hands on lab demonstrations- guided discussion – guided discovery	**Direct** (formative and summative): Evaluation of assignments, Step-by-step checkpoint assessment of experiment, In lab interactive questioning, quizzes, written exams **Indirect:** student survey
2.4	**Develop** competencies in communication, critical thinking and reporting during lab work.	Lectures, blackboard and visualization, brain storming, group and interactive discussion, Interactive illustration – Problem based learning	**Direct** (formative and summative): In class interactive questioning, quizzes, written exams **Indirect:** student survey
3.0	**Values**		
3.1	**Demonstrate** abilities to work in groups and bear individual responsibility during lab work, interactive discussion and group assignments.	Interactive and Group discussion, expository and discovery teaching	**Direct** (formative and summative): In lab interactive questioning **Indirect**: student survey
3.2	**Show** awareness of safety for own and others when dealing with lab equipment's	Case study- interactive demonstration- guided discussion	**Direct** (formative and summative): In lab interactive questioning **Indirect**: student survey

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	**Homework assignment- Contribution in interactive discussion**	**3**	**2 (2%)**
2	**Lecture Quiz 1**	**4**	**2 (2%)**
3	**First Mid-term exam**	**6**	**10 (10%)**
4	**Homework assignment- Contribution in interactive discussion**	**8**	**2 (2%)**
5	**Lecture Quiz 2**	**9**	**2 (2%)**
6	**Second mid-term exam**	**11**	**10 (10%)**
7	**Homework assignment- Contribution in interactive discussion- Group work-essay or Project discussion**	**12**	**2 (2%)**
8	**Laboratory Exam (includes report, oral interview, and practical exam in both theory and experiments)**	**14**	**20 (20%)**
9	**Final Exam**	**16**	**50 (50%)**

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice : Each group of students is assigned to a staff member who will be available for help and academic guidance office hours at specific 2h on daily basis.

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	**The Physics of Atom and Quanta; Hermann Hacken, and Hans Christoph Wolf; 7th ed Springer-Verlage 2005.**
Essential References Materials	**- Introduction to Atomic and Nuclear Physics; H. Semat, Holt McDougal; 5th edition 1972.** **Atomic Physics; C. Foot, Oxford University Press, USA; 1st edition, 2005.**
Electronic Materials	https://en.wikipedia.org/wiki/Aomic_physics https://www.britannica.com/science/atomic-physics http://www.atomicarchive.com/Physics/Physics1.shtml https://opentextbc.ca/physicstestbook2/chapter/introduction-to-atomic-physics/
Other Learning Materials	

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	Class room- if possible room for interactive discussion (round table)
Technology Resources (AV, data show, Smart Board, software, etc.)	Data show- smart board
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	Equipment to perform lab. experiments as per the Lab. manual

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of teaching	Students, Peer and program leader	Indirect (CES)- Indirect peer evaluation
Assessment	Students, Program assessment committee	Direct/ Indirect
Extent of achievement of course learning outcomes	Instructor	Direct/Indirect
Quality of learning resources	Students, Faculty members	Indirect

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)

Evaluators (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

H. Specification Approval Data

Council / Committee	**Department council**
Reference No.	**8**
Date	**16/4/1442**

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

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2020

Course Specifications

Course Title:	Analytical Mechanics
Course Code:	**351PHYS**
Program:	**Physics**
Department:	**Physics**
College:	**Science**
Institution:	**Jazan University**

Table of Contents

A. Course Identification

1. Credit hours: 3	
2. Course type	
a. University ☐ College ☐ Department √ Others ☐	
b. Required √ Elective ☐	
3. Level/year at which this course is offered: Level 5/ Year 3	
4. Pre-requisites for this course (if any)**:251 PHYS**	
5. Co-requisites for this course (if any)**: NIL**	

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	38	84%
2	Blended	7	16%
3	E-learning		
4	Correspondence		
5	Other		

7. Contact Hours (based on academic semester)

No	Activity	Contact Hours
1	Lecture	42
2	Laboratory/Studio	--
3	Tutorial	3
4	Others (specify)	
	Total	45

B. Course Objectives and Learning Outcomes

1. Course Description

The course covers the topics of: the dynamics of systems of particles, the elastic and inelastic collisions in center of mass and laboratory coordinates, the mechanics of rigid bodies, and finally the Lagrangian and Hamiltonian mechanics

2. Course Main Objective

The course is designed to provide students with

1. A full description for the dynamics of discrete and continuous systems of particles
2. A deep understanding for the collisions and scattering of the particles in both of the center of mass and lab coordinates
3. Mathematical skills to calculate the center of mass and moment of inertial of

different rigid bodies shapes 4. Theoretical description to the rotation of rigid bodies around a fixed and rotated axis 5. The use of variational principle to derive the Euler- Lagrange equation 6. Apply the Euler-Lagrange equation to describe the mechanics of particular physical systems in the generalized coordinates 7. The use of the Hamiltonian equations in different physical problems

3. Course Learning Outcomes

	CLOs	Aligned PLOs
1	**Knowledge and Understanding**	
1.1	**Describe:** the angular moment, the torque, and the kinetic energy of the system of particles. The elastic and inelastic collisions, the impulse, the reduced mass of the colloidal particles. The center of mass, the product of inertia, and the moment of inertial tensor of rigid body, the variation principles in the Largangian mechanics.	**PLO1.1**
1.2	**State**: comparison between the Lab and the center of mass coordinates. The generalized coordinates in the Largangian mechanics, the Euler-Lagrange equation of motion and the Hamiltonian equation	**PLO1.2**
1.3	**Discus** The properties of the rotation of the system of particles. The principal of conservation of linear momentum of collided particles	**PLO1.2**
2	**Skills :**	
2.1	**Derive** the angular momentum and torque equation for the system of particles. The rotational kinetic energy of rigid bodies. The Euler-Lagrange and the Hamiltonian equations of motion	**PLO2.2**
2.2	**Apply** The conservation laws to study the collision and scattering of collided particles. The Lagrange equation and Hamiltonian equation to solve some physical problems (simple pendulum, Atwood, inclined motion, ..)	**PLO2.1**
2.3	**Calculate** the center of mass and moment of inertial tensor of different rigid bodies	**PLO2.1**
2.4	**Analyze** the rotation of a rigid body around the axis of symmetry and relative to a fixed coordinate system:	**PLO2.2**
2.5	**Develop** communication and critical thinking competencies during interactive discussion, group assignments, essays or web-based activities	**PLO2.4**
3	**Values:**	
3.1	**Develop** skills of working in groups in group assignments and discussion and bear individual responsibility in the assigned tasks	**PLO3.1**

C. Course Content

No	List of Topics	Contact Hours
1	**1- Dynamics of systems of particles** (center of mass and linear momentum of a system, Angular Momentum and Kinetic Energy of a system, Motion of two interacting bodies: The reduced Mass).	**9**
2	**2- Collisions** (Oblique and scattering collisions).	**6**

3	**3- The Rigid bodies** mechanics (General theories and its applications on many types of motion, motion of rigid bodies in three dimensions.)	**9**
4	**4- Lagrangian Mechanics.**	**9**
5	**5- Hamiltonian Mechanics**	**9**
6	review	3
Total		**45**

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge and Understanding**		
1.1	**Describe:** the angular moment, the torque, and the kinetic energy of the system of particles. The elastic and inelastic collisions, the impulse, the reduced mass of the colloidal particles. The center of mass, the product of inertia, and the moment of inertial tensor of rigid body, the variation principles in the Largangian mechanics.	Lectures, discussion comparisons	**Direct** (formative and summative): In class interactive questioning, quizzes, written exams **Indirect:** student survey
1.2	**State**: comparison between the Lab and the center of mass coordinates. The generalized coordinates in the Largangian mechanics, the Euler-Lagrange equation of motion and the Hamiltonian equation	Lectures, discussion	**Direct** (formative and summative): In class interactive questioning, quizzes, written exams **Indirect:** student survey
1.3	**Discus** The properties of the rotation of the system of particles. The principal of conservation of linear momentum of collided particles	Lectures, discussion	**Direct** (formative and summative): In class interactive questioning, quizzes, written exams **Indirect:** student survey
2.0	**Skills**		
2.1	**Derive** the angular momentum and torque equation for the system of particles. The rotational kinetic energy of rigid bodies. The Euler-Lagrange and the Hamiltonian equations of motion	Lectures, discussion	**Direct** (formative and summative): In class interactive questioning, quizzes, written exams **Indirect:** student survey
2.2	**Apply** The conservation laws to study the collision and scattering of collided particles**.** The Lagrange equation and Hamiltonian equation to solve some physical problems (simple pendulum, Atwood, inclined motion, ..)	Lectures, discussion, Tutorial	**Direct** (formative and summative): In class interactive questioning, quizzes, written exams **Indirect:** student survey
2.3	**Calculate** the center of mass and moment of inertial tensor	Lectures, Discussion, Tutorial	**Direct** (formative and summative): In class

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
	of different rigid bodies		interactive questioning, quizzes, written exams **Indirect:** student survey
2.4	**Analyze** the rotation of a rigid body around the axis of symmetry and relative to a fixed coordinate system:	Lectures, Discussion, Tutorial	**Direct** (formative and summative): In class interactive questioning, quizzes, written exams **Indirect:** student survey
2.5	**Develop** communication and critical thinking competencies during interactive discussion, group assignments, essays or web-based activities	Lectures, Discussion, Tutorial	**Direct** (formative and summative): In class interactive questioning, quizzes, written exams **Indirect:** student survey
3.0	**Values**		
3.1	**Develop** skills of working in groups in group assignments and discussion and bear individual responsibility in the assigned tasks	Discussion, question and answer	**Direct** In class interactive questioning, quizzes, written exams **Indirect:** student survey

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	**Assignment 1**	**3**	**2.5** (2.5%)
2	**Assignment 2**	**6**	**2.5** (2.5%)
3	**Quiz I**	**7**	**5** (5 %)
4	**First Mid-term exam**	**8**	**15** (15%)
5	**Assignment 3**	**11**	**2.5** (2.5%)
6	**Assignment 4**	**13**	**2.5** (2.5%)
7	**Quiz II**	**14**	**5** (5%)
8	**Second mid-term exam**	**14**	**15** (15%)
9	**Final Exam**	**16**	**50** (50%)

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice :

Each group of students is assigned to a staff member who will be available for help and academic guidance office hours at specific 2hr on daily basis.

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	Analytical Mechanics; G. R. Fowls and G. Cassiday – 7 th edition, Brooks, Cole, publishing, 2004.

Essential References Materials	-Classical Mechanics; V. Barges and M. Olsson, McGraw Hill, 1995. - Classical Mechanics; T. L. Chow, John Wiley and Son Ltd, 1995.
Electronic Materials	• *e-Learning* in the School of *Physics* and Astronomy *(www.ph.ed.ac.uk/elearning)* • Physical Sciences Resource Center (PSRC) (www.psrc-online.org*)* • The Physics Homepage *(www.physics.ox.ac.uk)*
Other Learning Materials	• Mathematical packages: *Mathematica*, Math Lab, and Maple. • Software: Virtual Physics

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	Class room
Technology Resources (AV, data show, Smart Board, software, etc.)	Data show- smart boar
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	None

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of teaching	Students, Peer and program leader	Indirect (CES)- Indirect peer evaluation
Assessment	Students, Program assessment committee	Direct/ Indirect
Extent of achievement of course learning outcomes	Instructor	Direct/Indirect
Quality of learning resources	Students, Faculty members	Indirect

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)
Evaluators (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

H. Specification Approval Data

Council / Committee	Department council
Reference No.	8
Date	16/4/1442

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

اعتماد
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2020

Course Specifications

Course Title:	Quantum Mechanics I
Course Code:	**352PHYS**
Program:	**Physics**
Department:	**Physics**
College:	**Science**
Institution:	**Jazan University**

Table of Contents

A. Course Identification

1. Credit hours: 3								
2. Course type								
a.	University	☐	College	☐	Department	√	Others	☐
b.	Required	√	Elective	☐				
3. Level/year at which this course is offered: Level 6/ Year 3								
4. Pre-requisites for this course (if any)**:252 PHYS**								
5. Co-requisites for this course (if any)**: NIL**								

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	38	84%
2	Blended	7	16%
3	E-learning		
4	Correspondence		
5	Other		

7. Contact Hours (based on academic semester)

No	Activity	Contact Hours
1	Lecture	42
2	Laboratory/Studio	--
3	Tutorial	3
4	Others (specify)	
	Total	45

B. Course Objectives and Learning Outcomes

1. Course Description

This course covers fundamental concepts of quantum mechanics: wave properties, uncertainty principles, Schrödinger equation, and operator and matrix methods. Basic applications of the following are discussed: one-dimensional potentials (harmonic oscillator), three-dimensional central potentials (hydrogen atom), and angular momentum and spin.

2. Course Main Objective

The course is designed to provide students with
Justification of the failure of classical physics to explain many phenomena.
- An introduction to the conceptual and mathematical foundations of quantum mechanics.
- Analytical methods commonly used in quantum mechanics.
- The foundations for further studies infields of atomic and nuclear spectroscopy, elementary particle physics and solid state physics as well as more advanced quantum mechanics.

3. Course Learning Outcomes

CLOs		Aligned PLOs
1	**Knowledge and Understanding**	
1.1	**Describe** the kinds of experimental results which are incompatible with classical physics and which required the development of a quantum theory of matter and light.	**PLO 1.2**
1.2	**Write the** general time Schrödinger equation within different potentials and different coordinates, Hilbert space and Hermitian operators and their vital use in quantum mechanics	**PLO 1.1**
2	**Skills :**	
2.1	**Apply** the basic postulates of quantum mechanics, the role of uncertainty in quantum physics to a particle's physical properties such as position, momentum and energy, and use the commutation relations of operators to determine whether or not two physical properties can be simultaneously measured	**PLO2.1**
2.2	**Analyze** the Schrödinger equation in one dimension within different experimental phenomena (different potentials)	**PLO2.2**
2.3	**Formulate** the Schrödinger equation in three dimensions using spherical coordinates and	**PLO2.2**
2.4	**Derive** analytical results for spherically symmetric potentials (Hydrogen atom)	**PLO2.2**
2.5	**Develop** communication and critical thinking competencies during interactive discussion, group assignments, essays or web-based activities	**PLO2.4**
3	**Values:**	
3.1	**Develop** skills of working in groups in group assignments and discussion and bear individual responsibility in the assigned tasks	**PLO 3.1**

C. Course Content

No	List of Topics	Contact Hours
1	**1- Introduction to Quantum Mechanics**	**3**
2	**2- The Postulates Quantum Mechanics**	**6**
3	**3- The Wave Function** • The Schrodinger Equation • The Statistical Interpretation • Probability • Normalization • Momentum • The Uncertainty Principle	**6**
4	**4- Formalism (Mathematics of Quantum Mechanics)** • Linear Algebra • The Uncertainty Principle,	**6**
5	**5- The time-independent Schrodinger equation.** • Stationary States • The Infinite Square Well • The Harmonic Oscillator	**9**

	• The Free Particle • The Delta-Function Potential • The Finite Square Well	
6	**6- <u>Quantum Mechanics in 3D</u>** • Schrodinger Equations in Spherical Coordinates • The Hydrogen Atom • Angular Momentum • Spin	12
7	**Review**	3
	Total	**45**

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge and Understanding**		
1.1	**Describe** the kinds of experimental results which are incompatible with classical physics and which required the development of a quantum theory of matter and light.	Lectures, discussion comparisons	**Direct** (formative and summative): In class interactive questioning, quizzes, written exams **Indirect:** student survey
1.2	**Write the** general time Schrödinger equation within different potentials and different coordinates, Hilbert space and Hermitian operators and their vital use in quantum mechanics	Lectures, discussion	**Direct** (formative and summative): In class interactive questioning, quizzes, written exams **Indirect:** student survey
2.0	**Skills**		
2.1	**Apply** the basic postulates of quantum mechanics, the role of uncertainty in quantum physics to a particle's physical properties such as position, momentum and energy, and use the commutation relations of operators to determine whether or not two physical properties can be simultaneously measured	Lectures, discussion	**Direct** (formative and summative): In class interactive questioning, quizzes, written exams **Indirect:** student survey
2.2	**Analyze** the Schrödinger equation in one dimension within different experimental phenomena (different potentials)	Lectures, discussion, Tutorial	**Direct** (formative and summative): In class interactive questioning, quizzes, written exams **Indirect:** student survey
2.3	**Formulate** the Schrödinger equation in three dimensions using spherical coordinates and	Lectures, Discussion, Tutorial	**Direct** (formative and summative): In class interactive questioning, quizzes, written exams **Indirect:** student survey
2.4	**Derive** analytical results for spherically symmetric potentials (Hydrogen atom)	Lectures, Discussion, Tutorial	**Direct** (formative and summative): In class

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
			interactive questioning, quizzes, written exams **Indirect:** student survey
3.0	**Values**		
3.1	**Develop** skills of working in groups in group assignments and discussion and bear individual responsibility in the assigned tasks	Discussion, question and answer	**Direct** In class interactive questioning, quizzes, written exams **Indirect:** student survey

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	**Assignment 1**	**3**	**2.5** (2.5%)
2	**Assignment 2**	**6**	**2.5** (2.5%)
3	**Quiz I**	**7**	**5** (5 %)
4	**First Mid-term exam**	**8**	**15** (15%)
5	**Assignment 3**	**11**	**2.5** (2.5%)
6	**Assignment 4**	**13**	**2.5** (2.5%)
7	**Quiz II**	**14**	**5** (5%)
8	**Second mid-term exam**	**14**	**15** (15%)
9	**Final Exam**	**16**	**50** (50%)

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice :

Each group of students is assigned to a staff member who will be available for help and academic guidance office hours at specific 2hr on daily basis.

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	Introduction to Quantum Mechanics; David J. Griffiths, CAMBRIDGE UNIVERSITY PRESS, 2017.
Essential References Materials	1. -Introductory Quantum Mechanics; R. Liboff, 4th Edition, Addison-Wesley, 2002. 2. Quantum Mechanics; Sara M. Mc Murry, Addison-Wesley, 1994
Electronic Materials	• *e-Learning* in the School of *Physics* and Astronomy *(www.ph.ed.ac.uk/elearning)* • Physical Sciences Resource Center (PSRC) (www.psrc-online.org*)* • The Physics Homepage *(www.physics.ox.ac.uk)*

Other Learning Materials	• Mathematical packages: *Mathematica*, Math Lab, and Maple. • Software: Virtual Physics

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	Class room
Technology Resources (AV, data show, Smart Board, software, etc.)	Data show- smart boar
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	None

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of teaching	Students, Peer and program leader	Indirect (CES)- Indirect peer evaluation
Assessment	Students, Program assessment committee	Direct/ Indirect
Extent of achievement of course learning outcomes	Instructor	Direct/Indirect
Quality of learning resources	Students, Faculty members	Indirect

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)
Evaluators (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

H. Specification Approval Data

Council / Committee	Department council
Reference No.	8
Date	16/4/1442

Course Specifications

Course Title:	Statistical Physics
Course Code:	**353PHYS**
Program:	**Physics**
Department:	**Physics**
College:	**Science**
Institution:	**Jazan University**

Table of Contents

A. Course Identification

1. **Credit hours:2**	
2. **Course type**	
a. University ☐ College ☐ Department ☑ Others ☐	
b. Required ☑ Elective ☐	
3. **Level/year at which this course is offered: Level 2/ Year 3**	
4. **Pre-requisites for this course** (if any)**: 222 PHYS**	
5. **Co-requisites for this course** (if any)**: 301STAT**	

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	25	83%
2	Blended	5	17%
3	E-learning		
4	Correspondence		
5	Other		

7. Contact Hours (based on academic semester)

No	Activity	Contact Hours
1	Lecture	30
2	Laboratory/Studio	
3	Tutorial	
4	Others (specify)	
	Total	30

B. Course Objectives and Learning Outcomes

1. Course Description

Statistical Physics is a probabilistic approach to equilibrium properties of systems with large number of degrees of freedom. Topics include: introduction to statistical methods, statistical description of systems of particles (Methodology of Statistical Mechanics), classical statistical mechanics, and quantum statistical mechanics (Bose-Einstein and Fermi-Dirac Statistics).

2. Course Main Objective

This course is designed to provide students with:

- Introduction to statistical methods based on the probability theory.
- Statistical description of systems of particles
- Classical statistical ensembles (micro-canonical, canonical, grand canonical)
- Introduction to the quantum statistical mechanics

3. Course Learning Outcomes

	CLOs	Aligned PLOs
1	**Knowledge and Understanding**	
1.1	**Describe** the statistical nature of concepts and laws in thermodynamics,	**PLO1.1**
1.2	**Define** statistical function, such as Boltzmann distribution, Gibbs distribution, Fermi-Dirac and Bose-Einstein distributions to solve problems in some physical systems	**PLO1.1**
1.3	**Explain** the fundamental postulates of statistical mechanics	**PLO1.2**
1...		
2	**Skills :**	
2.1	**Calculate** statistical properties for systems such as gases, solids, photons or vibrations.	**PLO2.1**
2.2	**Compare** between statistical laws of classical particles, bosons and fermions	**PLO2.2**
2.3	**Develop** communication and critical thinking competencies during interactive discussion, group assignments, essays or web-based activities	**PLO2.4**
3	**Values:**	
3.1	**Develop** skills of group working in group assignments and discussion and bear individual responsibility in the assigned tasks	**PLO3.1**

C. Course Content

No	List of Topics	Contact Hours
1	**Introduction to Statistical Physics**	**6**
2	**Statistical description of systems of particles (Methodology of Statistical Mechanics)**	**8**
3	**Classical Statistical Mechanics**	**8**
4	**Quantum Statistical Mechanics**	**6**
5	**Review**	**2**
	Total	**30**

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge and Understanding**		
1.1	**Describe** the statistical nature of concepts and laws in thermodynamics,	Lectures, discussion	**Direct** (formative and summative): In class interactive questioning, quizzes, written exams **Indirect:** student survey
1.2	**Define** statistical function, such as Boltzmann distribution, Gibbs distribution, Fermi-Dirac and Bose-Einstein distributions to solve problems in some physical systems	Lectures, discussion	**Direct** (formative and summative): In class interactive questioning, quizzes, written exams **Indirect:** student survey
1.3	**Explain** the fundamental postulates of statistical mechanics	Lectures,	**Direct** (formative and

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
		discussion	summative): In class interactive questioning, quizzes, written exams **Indirect:** student survey
2.0	**Skills**		
2.1	**Calculate** statistical properties for systems such as gases, solids, photons or vibrations.	Lectures, discussion	**Direct** (formative and summative): In class interactive questioning, quizzes, written exams **Indirect:** student survey
2.2	**Compare** between statistical laws of classical particles, bosons and fermions	Lectures, discussion	**Direct** (formative and summative): In class interactive questioning, quizzes, written exams **Indirect:** student survey
2.3	**Develop** communication and critical thinking competencies during interactive discussion, group assignments, essays or web-based activities	Discussion	**Direct**: In class interactive questioning, quizzes, written exams **Indirect:** student survey
3.0	**Values**		
3.1	**Develop** skills of working in groups in group assignments and discussion and bear individual responsibility in the assigned tasks	Discussion	**Direct**: In class interactive questioning, quizzes, written exams **Indirect:** student survey

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	**Homework assignment**	**2**	**2** (3%)
2	**Lecture Quiz 1**	**4**	**5** (5%)
3	**Homework assignment**	**4**	**2 (2%)**
4	**First Mid-term exam**	**6**	**15** (15%)
5	**Homework assignment**	**6**	**2** (3%)
6	**Homework assignment**	**8**	**2** (3%)
7	**Practical web based home work**	**10**	**5** (5%)
8	**Home work assignment**	**10**	**2 (2%)**
9	**Second mid-term exam**	**11**	**15** (15%)
10	**Final Exam**	**16**	**50** (50%)

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice :

Each group of students is assigned to a staff member who will be available for help and academic guidance office hours at specific 2h on daily basis.

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	Fundamentals of Statistical and Thermal Physics ; F. Reif, McGraw–Hill, 2002
Essential References Materials	- Thermodynamics, Kinetic Theory and Statistical Thermodynamics; F.W. Sears and G. L Salinger, John Wiley& Sons, Inc., 1975. - Introduction to Statistical Physics, W. G. Rosswe, Ellis Horwood, Ltd. 1982
Electronic Materials	- http://www.wikipedia.org/ - http://www.hazemsakeek.com/
Other Learning Materials	

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	Class room
Technology Resources (AV, data show, Smart Board, software, etc.)	Blackboard
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	None

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of teaching	Students, Peer and program leader	Indirect (CES)- Indirect peer evaluation
Assessment	Students, Program assessment committee	Direct/ Indirect
Extent of achievement of course learning outcomes	Instructor	Direct/Indirect
Quality of learning resources	Students, Faculty members	Indirect

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)
Evaluators (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

H. Specification Approval Data

Council / Committee	Depaertment council
Reference No.	8
Date	1442/16

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

اعتماد NCAAA T4 2020

Course Specifications

Course Title:	Solid State Physics I
Course Code:	371 PHYS
Program:	Physics (undergraduate)
Department:	Physics
College:	Science
Institution:	Jazan University

Table of Contents

A. Course Identification

1. Credit hours: 4								
2. Course type								
a.	University	☐	College	☐	Department	v	Others	☐
b.	Required	v	Elective	☐				
3. Level/year at which this course is offered: Level 8/Year 4								
4. Pre-requisites for this course (if any)**: 311 PHYS**								
5. Co-requisites for this course (if any)**:NIL**								

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	42	88%
2	Blended	6	12%
3	E-learning		
4	Distance learning		
5	Other (lab)		

7. Contact Hours (based on academic semester)

No	Activity	Contact Hours
1	Lecture	42
2	Laboratory/Studio	
3	Tutorial	3
4	**Others** (specify)	--
	Total	45

B. Course Objectives and Learning Outcomes

1. Course Description

This course is intended to provide an introduction to the physics of solids including the properties of static (crystal structure), dynamic (lattice vibrations) arrangements of atoms and X-ray diffraction. Next, we will study electron theory in metals and will identify key features distinguishing metals, insulators and semiconductors

2. Course Main Objective

This course is designed to provide students with:

- ✓ The fundamental of crystal structures and symmetry.
- ✓ The relationship between atomic bonding and various mechanical, thermal, and electronic properties.
- ✓ The concept of defects in solids.
- ✓ The essential elements of analysis of crystal structures using x-ray diffraction techniques.
- ✓ The theory of lattice vibrations (phonons).
- ✓ The principal of free electron theory and the classes of magnetic materials.

3. Course Learning Outcomes

	CLOs	Aligned PLOs
1	**Knowledge and Understanding**	
1.1	**Define** the concept of Crystal structure (crystal lattice, the base, principal vectors, unit cell, the crystal symmetrical properties, crystal planes, Miller indices**),** the various atomic bonds**,** the lattice vibrations, phonons and defects in crystals and the magnetic properties of solids, the classical free electron theory in metals, Drude model and Debye Model.	**PLO1.1**
1.2	**Discuss** the reciprocal lattice, the crystal structure for a given solid based on X-ray diffraction, the contribution of phonons and electrons to the specific heat capacity of solids and the Magnetic properties of solids when placed in an external magnetic field.	**PLO1.2**
1.3	**Describe** the concept of Crystal structure (crystal lattice, the base, principal vectors, unit cell, the crystal symmetrical properties, crystal planes, Miller indices**),** the various atomic bonds**,** the lattice vibrations, phonons and defects in crystals and the magnetic properties of solids.	**PLO1.2**
2	**Skills :**	
2.1	**Calculate** the theoretical density and the APF of solid crystal, the contributions of phonons to specific heat and thermal conductivity, the fundamental properties of metals using Drude model (electrical conductivity, Hall effect and the magnetic resistance), the net magnetization of an object and the magnetic permeability-susceptibility of permeability of a solid.	**PLO2.1**
2.2	**Derive** the dispersion relation for the vibrational modes for monoatomic and diaatomic crystal, the phonon contribution to the heat capacity at low and high temperatures, the classical free electron theory in metals (Drude model), quantum theory to define the Fermi energy of a metal	**PLO2.2**
3.1	**Develop** communication and critical thinking competencies during interactive discussion, group assignments, essays or web-based activities, self-learning awareness	**PLO2.3**
3	**Values:**	
3.1	**Demonstrate** effective collaboration among group and bear individual responsibility during group work and /or assignments	**PLO3.1**

C. Course Content

Theoretical Part

No	List of Topics	Contact Hours
1	**Crystal Structure:** Bravais lattice, primitive cell, lattice with a basis, common crystal structures (simple cubic, face centered cubic, body centered cubic, diamond, and hexagonal), miller indices, and classification of Bravais lattice. -	**6**
2	**The reciprocal lattice:** definition of reciprocal lattice, construction of a reciprocal lattice, Brillouin zones, and lattice planes and reciprocal vectors.	**6**
3	**Crystal binding:** crystals of inert gases, ionic crystals, covalent crystals, and metallic bonds.	**4**
4	**Defects in solids:** amorphous solids; localized and extended defects.	**4**
5	**X-ray diffraction:** Bragg's law, von Laue's formulation, experimental geometries	**5**

	suggested by the Laue condition, and structural factors.	
6	**Phonons:** Lattice vibration, quantization of elastic waves, phonon momentum, heat capacity, thermal conductivity.	**6**
7	**Magnetic Properties of Materials:** Basic Concepts in Magnetism, Diamagnetism, Paramagnetism, Ferromagnetism, Antiferromagnetism, Ferrimagnetism, Langevin Theory of Diamagnetism Quantum Mechanical Considerations:	**4**
8	**The Drude theory of metals:** basic assumptions of Drude model, DC electrical conductivity of a metal, Hall effect and magnetoresistance.	**7**
9	**Review**	**3**
	Total	**45**

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge and Understanding**		
1.1	**Define** the concept of Crystal structure (crystal lattice, the base, principal vectors, unit cell, the crystal symmetrical properties, crystal planes, Miller indices**),** the various atomic bonds**,** the lattice vibrations, phonons and defects in crystals and the magnetic properties of solids, the classical free electron theory in metals, Drude model and Debye Model.	Lectures, blackboard and diagram illustration, group discussion, Interactive illustrations- Student contribution	**Direct** (formative and summative): In class interactive questioning, quizzes, written exams **Indirect:** student survey
1.2	**Discuss** the reciprocal lattice, the crystal structure for a given solid based on X-ray diffraction, the contribution of phonons and electrons to the specific heat capacity of solids and the Magnetic properties of solids when placed in an external magnetic field. quantum theory to define the Fermi energy of a metal	Lectures, blackboard and visualization, brain storming, group and interactive discussion, Interactive illustration – Problem based learning	**Direct** (formative and summative): In class interactive questioning, quizzes, written exams **Indirect**: student survey
1.3	**Describe** the concept of Crystal structure (crystal lattice, the base, principal vectors, unit cell, the crystal symmetrical properties, crystal planes, Miller indices**),** the various atomic bonds**,** the lattice vibrations, phonons and defects in crystals and the magnetic properties of solids.	Lectures, blackboard and visualization, group and interactive guided discussion, Interactive discussion	**Direct** (formative and summative): In class interactive questioning, quizzes, written exams **Indirect**: student survey

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
2.0	**Skills**		
2.1	**Calculate** the theoretical density and the APF of solid crystal, the contributions of phonons to specific heat and thermal conductivity, the fundamental properties of metals using Drude model (electrical conductivity, Hall effect and the magnetic resistance), the net magnetization of an object and the magnetic permeability-susceptibility of permeability of a solid.	Lectures, blackboard and visualization, brain storming, group and interactive discussion, Interactive illustration – Problem based learning	**Direct** (formative and summative): In class interactive questioning, quizzes, written exams **Indirect**: student survey
2.2	Derive the dispersion relation for the vibrational modes for monoatomic and diaatomic crystal, the phonon contribution to the heat capacity at low and high temperatures, the classical free electron theory in metals (Drude model),	Derive the dispersion relation for the vibrational modes for monoatomic and diaatomic crystal, the phonon contribution to the heat capacity at low and high temperatures, the classical free electron theory in metals (Drude model),	Derive the dispersion relation for the vibrational modes for monoatomic and diaatomic crystal, the phonon contribution to the heat capacity at low and high temperatures, the classical free electron theory in metals (Drude model),
2.3	**Develop** communication and critical thinking competencies during interactive discussion, group assignments, essays or web-based activities, self-learning awareness	Interactive and Group discussion, expository and discovery teaching	**Direct** (formative and summative): **Indirect**: student survey
3.0	**Values**		
3.1	**Demonstrate** effective collaboration among group and bear individual responsibility during group work and /or assignments	Interactive and Group discussion, expository and discovery teaching	**Direct** (formative and summative): **Indirect**: student survey

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	**Homework assignment- Contribution in interactive discussion**	**2**	**3(3%)**
2	**Quiz 1**	**3**	**5 (5%)**
3	**First Mid-term exam**	7	**15 (15%)**
4	**Homework assignment- Contribution in interactive discussion**	**8**	**3 (3%)**
5	**Quiz 2**	**9**	**5 (5%)**
6	**Second mid-term exam**	**11**	**15 (15%)**
7	**Homework assignment- Contribution in interactive discussion- Group work-essay or Project discussion**	**12**	**4 (4%)**
9	**Final Exam**	**16**	**50 (50%)**

#	Assessment task*	Week Due	Percentage of Total Assessment Score

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice : **Each group of students is assigned to a staff member who will be available for help and academic guidance office hours at specific 2h on daily basis.**

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	C. Kittel. Introduction to Solid State Physics, 8th edn., Wiley, 2005
Essential References Materials	✓ Principles of the Solid State; H. V. Keer, Wiley Eastern Limited, London, 1993. ✓ The Solid State; H. M. Rosenberg, Oxford press, 1988
Electronic Materials	
Other Learning Materials	

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	1 Lecture room(s) for groups of 25 students.
Technology Resources (AV, data show, Smart Board, software, etc.)	Data show- smart board
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	None

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of teaching	Students, Peer and program leader	Indirect (CES)- Indirect peer evaluation
Assessment	Students, Program assessment committee	Direct/ Indirect
Extent of achievement of course learning outcomes	Instructor	Direct/Indirect

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Quality of learning resources	Students, Faculty members	Indirect
Effectiveness of teaching	Students, Peer and program leader	Indirect (CES)- Indirect peer evaluation

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)
Evaluators (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

H. Specification Approval Data

Council / Committee	**Department Council**
Reference No.	**8**
Date	**16/4/1442**

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

اعتماد NCAA T4 2020

Course Specifications

Course Title:	**Electronics 2**
Course Code:	**411PHYS-4**
Program:	**Physics**
Department:	**Physics**
College:	**Science**
Institution:	**Jazan University**

Table of Contents

A. Course Identification

1. Credit hours: **4**								
2. Course type								
a.	University	☐	College	☐	Department	√	Others	☐
b.	Required	√	Elective	☐				
3. Level/year at which this course is offered: **Level7/Year4**								
4. Pre-requisites for this course (if any)**:311PHYS (Electronics 1)**								
5. Co-requisites for this course (if any)**:NIL**								

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	40	44.4%
2	Blended	10	11.1 %
3	E-learning		
4	Distance learning		
5	Other (lab)	40	44.4 %

7. Contact Hours (based on academic semester)

No	Activity	Contact Hours
1	**Lecture**	42
2	**Laboratory/Studio**	42
3	**Tutorial**	6
4	**Others** (specify)	--
	Total	**90**

B. Course Objectives and Learning Outcomes

1. Course Description

This course is a continuation of Electronics 1 course. It covers different types of transistors, Amplifier circuits, Four layer devices, Silicon-controlled rectifiers, Diac, Triac, Silicon-controlled switch, Operational amplifiers, Digital logic circuits and their applications.

2. Course Main Objective

This course is designed to provide students with the following concepts:

- Physical background of different analog and digital electronic devices.
- Skills of using electronic devices in electronic circuits.
- The electronic devices circuits.
- The applications of different electronic circuits.
- The electronic devices to characterize and operate different electronic device circuits in the lab.

3. Course Learning Outcomes

	CLOs	Aligned PLOs
1	**Knowledge and Understanding**	
1.1	**Describe** different types of devices such as BJT,JFET, D-MOSFET, E-MOSFET, ideal, practical and negative feedback operational amplifier and logic gate devices and operations.	**PLO1.1**
1.2	**Explain** different types of transistor amplifiers and other analog and digital devices and their biasing arrangements.	**PLO1.1**
1.3	**Discuss** the functions and structure of different types of transistors, four layer diode, SCR, DIAC, TRIAC, SCS ,UJT analog devices , operational amplifiers and logic gates and their applications.	**PLO1.2**
2	**Skills :**	
2.1	**Solve** problems related to analog devices and digital gates.	**PLO2.1**
2.2	**Analyze and Draw** circuits and characteristic curves of different analog devices and different transistor amplifiers. Also analyze the signal processing for digital devices	**PLO2.2**
2.3	**Perform** experiments using different analog and digital devices and plot the characteristics of different types of devices	**PLO2.3**
2.4	**Develop** competencies in communication, critical thinking and reporting during lab work.	**PLO2.4**
3	**Values:**	
3.1	**Demonstrate** skills to work in groups, also take responsibility for individual tasks during group assignments and lab work and practice safety awareness in the lab.	**PLO3.1,**
3.2	**Develop** competencies in communication, critical thinking and reporting during lab work, interactive discussion and group assignments.	**PLO3.3**

C. Course Content

Theoretical Part

No	List of Topics	Contact Hours
1	**Bipolar junction transistor and its bias circuits:** Transistor structure, basic operations, characteristics and parameters, transistor as a switch, transistor as amplifier. D.C operating point, voltage-divider bias, other bias methods.	6
2	**Bipolar Junction transistor amplifier:** Amplifier Operations, amplifier circuits, CE, CB, CC amplifier, multi-stage amplifier.	6
3	**Field effect transistors:** Junction field effect transistor (JFET), JFET characteristics and parameters, metal oxide semiconductor field effect transistor (MOSFET), MOSFET characteristics and parameters, MOSFET biasing.	**6**
4	**Thyristors and other devices:** Four layer devices, silicon controlled rectifier (SCR), SCR applications, Diac and Triac, silicon controlled switch (SCS), uni-junction transistor (UJT).	**6**
5	**Operational amplifier:** Introduction to operational amplifier (Op-Amps), Op-Amps modes and parameters, Op-Amps with negative feedback	**6**
6	**Logic gates:** Inverter, AND gate, OR gate, NAND gate, NOR gate, Exclusive-OR and Exclusive- NOR gates, applications of the gates.	**3**
7	**Boolean Algebra and logic simplifications:** Boolean operations and expressions, lows and rules of Boolean algebra, DeMorgan's theorem, Boolean analysis of logic circuits.	**3**
8	**Combinational logic analysis:** Basic combinational logic circuits, combinational logic using NAND and NOR gates, logic circuits with pulse input waveforms.	**6**

9	Review	**3**
	Total	**45**

Experimental Part:

No	List of Topics	Contact Hours
1	Introduction and safety concepts	3
1	Measurements of D.C, A.C voltage and frequency using cathode ray oscilloscope	**3**
2	R,L,C and R.C A.C. circuits and applications.	**3**
3	Series resonance circuits and applications.	**3**
4	Forward and reverse characteristics of PN junction diodes and light emitting diodes.	**3**
5	Forward and reverse characteristics light emitting diodes characteristics.	**3**
6	Half-wave and full wave rectification.	**3**
7	Zener diode characteristics and applications as voltage regulator.	**3**
8	Bipolar junction transistor characteristics (BJT).	**3**
9	Junction field effect transistors (JFET) characteristics.	**3**
10	Operation amplifier circuits.	**3**
11	Logic gates and applications.	**6**
12	Review and lab. exam	**6**
	Total	**45**

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge and Understanding**		
1.1	**Describe** different types of devices such As BJT, JFET, D-MOSFET, E-MOSFET, ideal, practical and negative feedback operational amplifier	Lectures, blackboard and visualization, group and interactive guided discussion, Interactive discussion	**Direct** (formative and summative): In class interactive questioning, quizzes, written exams **Indirect**: student survey
1.2	**Explain** different types of transistor amplifiers and other analog and digital devices and their biasing arrangements.	Lectures, blackboard and diagram illustration, group discussion, Interactive illustrations- Student contribution	**Direct** (formative and summative): In class interactive questioning, quizzes, written exams **Indirect:** student survey
1.3	**Discuss** the functions and structure of different types of transistors, four layer diode, SCR, DIAC, TRIAC, SCS ,UJT analog devices , operational amplifiers and logic gates and their applications.	Lectures, blackboard and visualization, brain storming, group and interactive discussion, Interactive illustration –	**Direct** (formative and summative): In class interactive questioning, quizzes, written exams **Indirect**: student

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
		Problem based learning	survey
2.0	**Skills**		
2.1	**Solve** problems related to analog devices and digital gates.	Lectures, blackboard and visualization, brain storming, group and interactive discussion, Interactive illustration – Problem based learning	**Direct** (formative and summative): In class interactive questioning, quizzes, written exams **Indirect**: student survey
2.2	**Analyze and Draw** circuits and characteristic curves of different analog devices and different transistor amplifiers. Also analyze the signal processing for digital devices	Lectures, blackboard and visualization, brain storming, group and interactive discussion, Interactive illustration – Problem based learning	**Direct** (formative and summative): In class interactive questioning, quizzes, written exams **Indirect**: student survey
2.3	**Perform** experiments using different analog and digital devices and plot the characteristics of different types of electronic devices in listed in the course.	Hands on lab demonstrations- guided discussion – guided discovery	**Direct** (formative and summative): Evaluation of assignments, Step-by-step checkpoint assessment of experiment, In lab interactive questioning, quizzes, written exams **Indirect:** student survey
2.4	**Develop** competencies in communication, critical thinking and reporting during lab work.	Lectures, blackboard and visualization, brain storming, group and interactive discussion, Interactive illustration – Problem based learning	**Direct** (formative and summative): In class interactive questioning, quizzes, written exams **Indirect:** student survey
3.0	**Values**		
3.1	**Demonstrate** abilities to work in groups and bear individual responsibility during lab work, interactive discussion and group assignments.	Interactive and Group discussion, expository and discovery teaching	**Direct** (formative and summative): In lab interactive questioning **Indirect**: student survey
3.2	**Show** awareness of safety for own and others when dealing with lab equipment's	Case study- interactive demonstration- guided discussion	**Direct** (formative and summative): In lab interactive questioning **Indirect**: student survey

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Homework assignment- Contribution in interactive discussion	3	2 (2%)
2	Quiz 1	4	2 (2%)
3	First Mid-term exam	7	8 (8%)
4	Homework assignment- Contribution in interactive discussion	8	1 (1%)
5	Quiz 2	9	2 (2%)
6	Second mid-term exam	11	8 (8%)
7	Homework assignment- Contribution in interactive discussion- Group work-essay or Project discussion	12	2 (2%)
8	Laboratory Exam	14	25 (25%)
9	Final Exam	16	50 (50%)

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice :

Each group of students is assigned to a staff member who will be available for help and academic guidance office hours at specific 2hours on daily basis.

F. Learning Resources and Facilities

1. Learning Resources

Required Textbooks	Electronic Devices, T.L Floyd, Pearson Prentice Hall, Inc., 7th Edition, 2005. Digital Fundamentals, T.L Floyd, Pearson Prentice Hall, Inc., 9th Edition, 2006.
Essential References Materials	Electronics: Circuits and Devices; Ralph J. Smith, John-Wiley and Sons, Inc., 3rd Edition, 1987. • Electric Circuits; James W. Nilsson, Addison-Wesley Publishing Company Inc., 3rd Edition, 2007. Basic Electronics for Scientists; James J. Brophy, McGraw- Hill Kogakusha, Ltd., 1990.
Electronic Materials	http://www.electronic materials.com/ http://www.wikipedia.org/ http://prenhall.com/floyd Work Bench electronics software.
Other Learning Materials	--------

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	Class room- if possible room for interactive discussion (round table)
Technology Resources (AV, data show, Smart Board, software, etc.)	Data show- smart board
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	Equipment to perform lab. experiments as per the Lab. manual

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of teaching	Students, Peer and program leader	Indirect (CES)- Indirect peer evaluation
Assessment	Students, Program assessment committee	Direct/ Indirect
Extent of achievement of course learning outcomes	Instructor	Direct/Indirect
Quality of learning resources	Students, Faculty members	Indirect
Effectiveness of teaching	Students, Peer and program leader	Indirect (CES)- Indirect peer evaluation

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)
Evaluators (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

H. Specification Approval Data

Council / Committee	**Department council**
Reference No.	**8**
Date	**16/4/1442**

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

اعتماد
NCAAA
T4
2020

Course Specifications

Course Title:	**Laser and its Applications**
Course Code:	**412PHYS**
Program:	**Physics**
Department:	**Physics**
College:	**Science**
Institution:	**Jazan University**

Table of Contents

A. Course Identification

1. Credit hours: 3	
2. Course type	
a. University ☐ College ☐ Department ☑ v Others ☐	
b. Required ☑ v Elective ☐	
3. Level/year at which this course is offered: Level 7/ Year 4	
4. Pre-requisites for this course (if any)**: 312 PHYS**	
5. Co-requisites for this course (if any)**: NIL**	

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	**Traditional classroom**	**38**	**84%**
2	**Blended**	**7**	**16%**
3	**E-learning**		
4	**Distance learning**		
5	**Other**		

7. Contact Hours (based on academic semester)

No	Activity	Contact Hours
1	**Lecture**	**42**
2	**Laboratory/Studio**	**--**
3	**Tutorial**	**3**
4	**Others** (specify)	
	Total	**45**

B. Course Objectives and Learning Outcomes

1. Course Description

This course is designed to provide students with the fundamentals of laser oscillation, its properties and applications. It describes the interaction of photon with matter and covers the essential laser requirements, laser gain media, laser oscillations inside various resonators, and their stability conditions. It also discusses the laser beam characteristics, transformation, and mode structure. It enables students to explore some of the laser types and the related aspects of various technological applications that employ lasers and beam optics.

2. Course Main Objective

This course is designed to provide students with:

- The fundamentals and principles of light matter interactions.
- The essential concepts of laser oscillations, its operational requirements and laser beam properties.
- Adequate skills of formulations of laser rate equations in various systems, laser threshold conditions and some of the laser types and their characteristics.
- The basic analysis of the continuous-wave and pulsed laser operation using appropriate

formalisms.

- The criteria for assessment of optical resonator stability and mode structure.

The basics of some laser applications.

3. Course Learning Outcomes

	CLOs	Aligned PLOs
1	**Knowledge and Understanding**	
1.1	**Define** the main requirements of laser operation , beam properties and various processes in laser matter interaction	**PLO1.1**
1.2	**Describe** the laser beam parameters, various processes in laser oscillation, laser beam characteristics, and the suitable laser type for various applications	**PLO1.1**
1.3	**Discuss** various process in laser matter interaction, the stability of optical resonator, the output operation and mode structure, various parameters of different laser types and laser applications in various fields	**PLO1.2**
2	**Skills :**	
2.1	**Solve** problems related to laser matter interaction, stability of laser cavity, laser oscillations and laser beam characteristics	**PLO2.1**
2.2	**Derive** the Einstein relations, laser gain and other laser parameters from the laser rate equations and oscillation processes	**PLO2.2**
2.3	**Develop** critical thinking competencies on the analysis of laser principles, characteristics and applications	**PLO2.4**
2.4	**Demonstrate** communication skills during interactive discussion, group assignments, essays or web-based activities.	**PLO2.4**
3	**Values:**	
3.1	**Show** effective collaboration and bear individual responsibility during group work and/or assignments	**PLO3.1**
3.2	**Adopt** some practices of self and long life learning in the field of laser and its important applications through some essays and case studies	**PLO3.2**

C. Course Content

No	List of Topics	Contact Hours
1	**Laser Fundamentals:** The nature of light, Blackbody Radiation, The Einstein relations (Emission + Absorption), Rate equations (gain and population inversion), Pumping methods, Three and Four level systems, and Threshold condition of laser oscillation.	**12**
2	**Laser beam propagation and transformation:** Resonators and stability condition**,** Laser Modes (transverse and longitudinal modes)**.**	**6**
3	**Properties of Laser Radiation:** Coherence, Monochromaticity, Directionality, Focusing, and Brightness.	**3**
4	**Some types of lasers:** Gas lasers {Atomic (He-Ne)- Ionic (Argon)- Molecular (CO_2 , Excimer), Solid State Lasers (Raby, Nd:YAG, Ti:Sapphire), Semiconductor Lasers (GaA1As), Free electron laser	**9**
5	**Laser output:** Q-Switching, Methods of Q-Switch, Mode locking, and Methods of Mode Locking	**6**
6	**Laser's Applications:** Optical communication**,** Metrological and Scientifi Application**,** Medical, Industrial and Military Applications**,** Commercial an Information Applications**,** Holography and its Applications.	**6**
7	**Review**	**3**

Total	45

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge and Understanding**		
1.1	**Define** the main requirements of laser operation , beam properties and various processes in laser matter interaction	Lectures, blackboard and visualization, group and interactive guided discussion, Interactive discussion	**Direct** (formative and summative): In class interactive questioning, quizzes, written exams **Indirect**: student survey
1.2	**Describe** the laser beam parameters, various processes in laser oscillation, laser beam characteristics, and the suitable laser type for various applications	Lectures, blackboard and diagram illustration, group discussion, Interactive illustrations-Student contribution	**Direct** (formative and summative): In class interactive questioning, quizzes, written exams **Indirect:** student survey
1.3	**Discuss** various process in laser matter interaction, the stability of optical resonator, the output operation and mode structure, various parameters of different laser types and laser applications in various fields	Lectures, blackboard and visualization, brain storming, group and interactive discussion, Interactive illustration – Problem based learning	**Direct** (formative and summative): In class interactive questioning, quizzes, written exams **Indirect**: student survey
2.0	**Skills**		
2.1	**Solve** problems related to laser matter interaction, stability of laser cavity, laser oscillations and laser beam characteristics	Lectures, blackboard and visualization, brain storming, group and interactive discussion, Interactive illustration – Problem based learning	**Direct** (formative and summative): In class interactive questioning, quizzes, written exams **Indirect**: student survey
2.2	**Derive** the Einstein relations, laser gain and other laser parameters from the laser rate equations and oscillation processes	Lectures, blackboard and visualization, brain storming, group and interactive discussion, Interactive illustration – Problem based learning	**Direct** (formative and summative): In class interactive questioning, quizzes, written exams **Indirect**: student survey
2.3	**Develop** critical thinking competencies on the analysis of laser principles, characteristics and applications	Lectures, blackboard and visualization, brain storming, group and	**Direct** (formative and summative): In class interactive

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
		interactive discussion, Interactive illustration – Problem based learning	questioning, quizzes, written exams **Indirect:** student survey
2.4	**Demonstrate** communication skills during interactive discussion, group assignments, essays or web-based activities, self-learning awareness	Lectures, blackboard and visualization, brain storming, group and interactive discussion, Interactive illustration – Problem based learning	**Direct** (formative and summative): In class interactive questioning, quizzes, written exams **Indirect:** student survey
3.0	**Values**		
3.1	**Show** effective collaboration and bear individual responsibility during group work and/or assignments	Interactive and Group discussion, expository and discovery teaching	**Direct** (formative and summative): interactive questioning- group assignment **Indirect**: student survey
3.2	**Adopt** some practices of self and long life learning in the field of laser and its important applications through some essays and case studies	Discussion - Brain storming -guided group analysis	**Direct** (formative): - essays assignment- case study) **Indirect**: student survey- viva

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	**Homework assignment- Contribution in interactive discussion- Group work or Project**	**3**	**3** (3%)
2	**Lecture Quiz 1**	**4**	**5** (5%)
3	**First Mid-term exam**	**6**	**15** (15%)
4	**Homework assignment- Contribution in interactive discussion- Group work or Project**	**10**	**3** (3%)
5	**Lecture Quiz 2**	**11**	**5** (5%)
6	**Second mid-term exam**	**12**	**15** (15%)
7	**Homework assignment- Contribution in interactive discussion- Group work-essay or Project discussion**	**11**	**4** (4%)
9	**Final Exam**	**16**	**50** (50%)

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice : Each group of students is assigned to a staff member who will be available for help and academic guidance office hours at specific 2h on daily basis.

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	Lasers and Electro-optics: Fundamentals and Engineering, Christopher C. Davis, Cambridge University Press, 2nd Ed., 2014
Essential References Materials	-Principles of Laser, Orazio Sevelto- Translated by *David C. Hanna*, Springer, 5th Ed.2013 -Laser Fundamentals, William T. Silfvast, Cambridge University Press; 2nd Ed. 2008
Electronic Materials	http://ocw.mit.edu/courses/physics/ http://laserworld.com http://www.physics.org/explore.asp http://www.wikipedia.org/
Other Learning Materials	

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	Class room- if possible room for interactive discussion (round table)
Technology Resources (AV, data show, Smart Board, software, etc.)	Data show- smart board
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	none

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of teaching	Students, Peer and program leader	Indirect (CES)- Indirect peer evaluation
Assessment	Students, Program assessment committee	Direct/ Indirect
Extent of achievement of course learning outcomes	Instructor	Direct/Indirect
Quality of learning resources	Students, Faculty members	Indirect
Effectiveness of teaching	Students, Peer and program leader	Indirect (CES)- Indirect peer evaluation

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)
Evaluators (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

H. Specification Approval Data

Council / Committee	**Department council**
Reference No.	**8**
Date	**16/4/1442**

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

اعتماد
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2020

Course Specifications

Course Title:	**Modern Physics II**
Course Code:	**441PHYS**
Program:	**Physics**
Department:	**Physics**
College:	**Science**
Institution:	**Jazan University**

Table of Contents

A. Course Identification

1. Credit hours: 4							
2. Course type							
a.	University ☐	College ☐	Department ☑ √	Others ☐			
b.	Required ☑ √	Elective ☐					
3. Level/year at which this course is offered: $8^{th}/4^{th}$							
4. Pre-requisites for this course (if any)**:** **Modern Physics I (341PHYS)**							
5. Co-requisites for this course (if any)**:** **NIL**							

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	42	46.6 %
2	Blended	6	6.8 %
3	E-learning		
4	Distance learning		
5	Other	42	46.6%

7. Contact Hours (based on academic semester)

No	Activity	Contact Hours
1	**Lecture**	45
2	**Laboratory/Studio**	45
3	**Tutorial**	-
4	**Others** (Problem Solving Sessions, Quizzes, Interactive Sessions, Excel Problem solving, Office Hours)	50
	Total	140

B. Course Objectives and Learning Outcomes

1. Course Description

This is an advanced and continued Modern Physics I course offered to the 8 level undergraduate senior students at the Jazan University. Molecular Spectroscopy, Modern Methods of Optical Spectroscopy, Cosmology and the Progress in Quantum Physics are the main chapters to be covered in this course. Students learn the theory of molecular bonding, their properties and spectroscopy by means of vibration, rotation and the selection rules of molecules. In the optical spectroscopy, students learn about quantum beats, Doppler-free saturation spectroscopy and two-photon absorption and finally the level-crossing spectroscopy. Students then move to learn about the Universe by means of it's origin, evolution and ultimate fate. Last but not least, students learn about the major advancement of quantum physics, e.g. quantum computers, entanglement etc. Students are also required to perform the practical classes (labs) concerning to the course contents.

2. Course Main Objective

This course is designed to provide students with:

- The fundamental of molecular spectra, optical spectroscopy, modern cosmology and advance in quantum physics.
- Analyzing the molecular spectrum, explaining the optical spectroscopy, developing their ideas about modern cosmology and the advances in quantum world (e.g. quantum computing).
- Demonstrate concepts concerning the course by means of practical classes.
- To become familiar with the advanced and leading-edge current research fields in physics.

3. Course Learning Outcomes

	CLOs	Aligned PLOs
1	**Knowledge and Understanding**	
1.1	**<u>Define</u>** Relativistic Doppler shift, Resolving power, Covalent bond, Ionic bond, Bonding state, Antibonding state, Homonuclear bonding, Gravitational lensing, Einstein-Podolsky-Rosen (EPR) Paradox, Bell Inequalities	**PLO1.1**
1.2	**<u>Describe</u>** Cosmological Principle, Big Bang Hypothesis, The condition of laser frequency used in the Doppler free saturation spectroscopy, Rotational and vibrational selection rules of molecules, Hubble law, The factors which determine the relative number of neutrons and protons according to Big Bang hypothesis, the presence of dark matter and its types	**PLO1.1**
1.3	**<u>Discuss</u>** Entanglement, Bose-Einstein Condensates, Laser Cooling of Atoms, Quantum Computing.	**PLO1.2**
2	**Skills:**	
2.1	**<u>Solve</u>** the ionizing energy problems for molecules, coulomb energy of molecules, effective force constant calculation, vibrational energy, vibrational spacing, rotational energy, rotational spacing, distance galaxy, change in wavelength, universe age, universe temperature	**PLO2.1**
2.2	**<u>Demonstrate</u>** Doppler broadening represents an obstacle to measure a narrow spectral line, P_y states are less effective in binding the molecules than the P_x states, The measured bond angle for H_2O molecule is greater than the expected value (90°), at the universe age greater than 250 s, the formed ^3H and ^3He nuclei do not break apart and why.	**PLO2.2**
2.3	**<u>Perform</u>** experiments using different analog and digital devices and plot the characteristics of different types of devices, competencies in communication, critical thinking and reporting during lab work, interactive discussion and group assignments.	**PLO2.3**
2.4	**<u>Develop</u>** the basic idea of the laser cooling, the two photons absorption process, The problem of Doppler broadening, quantum entanglement, Lamb dip effect, quantum computing paradigm.	**PLO2.4**
3	**Values:**	
3.1	**<u>Show</u>** the paradigm of collaboration with effective collaboration, demonstrating the important skills to work in groups, while taking responsibility for individual tasks during group assignments and lab work and practice safety awareness in the lab.	**PLO3.1**

C. Course Content

No	List of Topics	Contact Hours
1	**Molecular Physics:** The Hydrogen molecule ion, Hydrogen molecule and covalent bond, Other covalent bonding molecule (pp covalent bonds, sp covalent bonds, sp hybrid states), Ionic bonding e.g NaCl and calculation of bonding energy, Molecular vibrations, Molecular rotations, Selection rules, Molecular spectra	
2	**Cosmology:** The origin of the universe**,** Expansion of the universe**,** Cosmic microwave background radiation**,** General Theory of Relativity**,** Test of General Theory of Relativity**,** Dark Matter and Black Holes**,** Big Bang cosmology**,** Formation of Nuclei and atoms**,** and Future of the universe	
3	**Modern Methods of Optical Spectroscopy:** Classical method**,** Quantum beats**,** Doppler effect**,** Doppler –free saturation spectroscopy**,** Doppler-free two –photon absorption**,** Level-crossing spectroscopy**,** and Laser cooling of atoms	
4	**Progress in Quantum Physics:** Quantum entanglement**,** Einstein-Podolsky-Rosen (EPR) Paradox, Bell's Inequalities, Introduction to quantum computers (History, Review of digital computers, Basic concept of the quantum computers), and Bose-Einstein Condensation.	
6	Review	**3**
Total		45

Experimental Part:

No	List of Topics	Contact Hours
1	Millikan's Oil-Drop Experiment	3
2	Determination of the specific Charge of the Electron (e/m) by the Deflection of Electrons in Thomson Tube	3
3	Determination of (e/m) from the full circular path of the electron moving in magnetic field	**6**
4	Photoelectric Effect	**3**
5	Investigating the energy spectrum of an X-ray tube as a function of the high voltage	3
6	Investigating the energy spectrum of an X-ray tube as a function of the emission current	3
7	Duane-Hunt relation and determination of Planck's Constant	3
8	Rutherford Scattering: measuring the scattering rate as a function of the scattering angle and the atomic number	3
9	Fine structure of the characteristic X-radiation of a molybdenum anode	**6**
10	Compton Effect: verifying the energy loss of the scattered X-ray quantum	**3**
Total		**27**

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge and Understanding**		
1.1	**Define** Relativistic Doppler shift, Resolving power, Covalent bond, Ionic bond, Dark matter, Bonding state, Antibonding state, Homonuclear bonding, Gravitational lensing, Einstein-Podolsky-Rosen (EPR) Paradox, Bell Inequalities	Lectures, blackboard and visualization, group and interactive guided discussion, Interactive discussion	**Direct:** (formative and summative): In class interactive questioning, quizzes, written exams **Indirect:** student survey
1.2	**Describe** Cosmological Principle, Big Bang Hypothesis, The condition of laser frequency used in the Doppler free saturation spectroscopy, Rotational and vibrational selection rules of molecules, Hubble law, The factors which determine the relative number of neutrons and protons according to Big Bang hypothesis	Lectures, blackboard and visualization, group and interactive guided discussion, Interactive discussion	**Direct:** (formative and summative): In class interactive questioning, quizzes, written exams **Indirect:** student Survey
1.3	**Discuss** Entanglement, Bose-Einstein Condensates, Laser Cooling of Atoms, Quantum Computing.	Lectures, blackboard and visualization, group and interactive guided discussion, Interactive discussion,	**Direct:** (formative and summative): In class interactive questioning, quizzes, written exams **Indirect:** student survey
2.0	**Skills**		
2.1	**Solve** the ionizing energy problems for molecules, coulomb energy of molecules, effective force constant calculation, vibrational energy, vibrational spacing, rotational energy, rotational spacing, distance galaxy, change in wavelength, universe age, universe temperature	Lectures, blackboard and visualization, brainstorming, group and interactive discussion, Interactive illustration, Problem-based Learning, Using Excel Sheet for problem solving	**Direct:** (formative and summative): In class interactive questioning, quizzes, written exams **Indirect:** student Survey
2.2	**Describe** The presence of dark matter, Doppler broadening represents an obstacle to measure a narrow spectral line, P_y states are less effective in binding the molecules than the P_x states, The measured bond angle for	Lectures, blackboard and visualization, group and interactive guided discussion, Interactive discussion. Movies	**Direct:** (formative and summative): In class interactive questioning, quizzes, written exams

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
	H_2O molecule is greater than the expected value (90°), At the universe age greater than 250 s, the formed ^3H and ^3He nuclei are not break apart.		**Indirect:** student survey
2.3	**Develop** the basic idea of the laser cooling, the two photons absorption process, The problem of Doppler broadening, quantum entanglement, Lamb dip effect, quantum computing paradigm	Lectures, blackboard and visualization, brainstorming, group and interactive discussion, Interactive illustration, Problem-based Learning	**Direct:** (formative and summative): In class interactive questioning, quizzes, written exams **Indirect:** student Survey
2.4	**Perform** experiments using different analog and digital devices and plot the characteristics of different types of devices	Lectures, blackboard and visualization, brainstorming, group and interactive discussion, Interactive illustration, Problem-based Learning	**Direct:** (formative and summative): In class interactive questioning, quizzes, written exams **Indirect:** student Survey
3.0	**Values**		
3.1	**Show** the paradigm of collaboration with effective collaboration, demonstrating the important skills to work in groups, while taking responsibility for individual tasks during group assignments and lab work and practice safety awareness in the lab.	Interactive and Group discussion, expository and discovery teaching	**Direct:** (formative and summative): In class interactive questioning, quizzes, written exams **Indirect:** student Survey

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Homework assignment- Contribution in interactive discussion	3	2 (2%)
2	Quiz 1	4	2 (2%)
3	First Mid-term exam	7	8 (8%)
4	Quiz 2	8	1 (1%)
5	Homework assignment- Contribution in interactive discussion	9	2 (2%)
6	Second mid-term exam	11	8 (8%)
7	Homework assignment- Contribution in interactive discussion- Group work-essay or Project discussion	12	2 (2%)
8	Laboratory Examination	14	25(25%)
9	Final Examination	16	50(50%)

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice : Each group of students is assigned to a staff member who will be available for help and academic guidance office hours at specific 2hours on daily basis.

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	1. **Modern Physics**; K. S. Krane, Wiley, John &Sons, Inc., 1995. 2. **The Physics of Atoms and Quanta**; H. Haken and H.C. Wolf, Springer, 6th edition 2000.
Essential References Materials	1. Concepts of Modern Physics; Arthur Beiser, McGraw-Hill Book Co., 1987. 2. Modern Physics, P. A. Tipler, and R. A. Llewellyn, Freeman, 4th edition 2002.
Electronic Materials	**http://www.wikipedia.org/**
Other Learning Materials	

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	Class Room
Technology Resources (AV, data show, Smart Board, software, etc.)	Multi-Media Projector
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	Modern Physics Laboratory

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of teaching	Students, Peers and Program Leader	Indirect (CES)- Indirect peer evaluation
Assessment	Students, Program assessment committee	Direct/Indirect
Extent of achievement of course learning outcomes	Instructor	Direct/Indirect
Quality of learning resources	Students, Faculty members	Indirect (CES)- Indirect peer evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)
Evaluators (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

H. Specification Approval Data

Council / Committee	**Department council**
Reference No.	**8**
Date	**16/4/1442**

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

اعتماد
NCAAA
T4
2020

Course Specifications

Course Title:	Quantum Mechanics II
Course Code:	**451PHYS**
Program:	**Physics**
Department:	**Physics**
College:	**Science**
Institution:	**Jazan University**

Table of Contents

A. Course Identification

1. **Credit hours:** 3	
2. **Course type** **a.** University ☐ College ☐ Department ☑ Others ☐ **b.** Required ☑ Elective ☐	
3. **Level/year at which this course is offered:** **Level 7/ Year 4**	
4. **Pre-requisites for this course** (if any)**: 352 PHYS**	
5. **Co-requisites for this course** (if any)**: NIL**	

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	39	87%
2	Blended	6	13%
3	E-learning		
4	Correspondence		
5	Other		

7. Contact Hours (based on academic semester)

No	Activity	Contact Hours
1	Lecture	45
2	Laboratory/Studio	--
3	Tutorial	
4	**Others** (specify)	
	Total	45

B. Course Objectives and Learning Outcomes

1. Course Description

This course is the continuation of Quantum Mechanics1. It mainly encompasses approximation techniques such as perturbation theory, variational principle, WKB method and Born approximation. These approximation techniques will be applied to calculate the energy and wave corrections to perturbed simple harmonic oscillator, relativistic correction to hydrogen atom and to study interaction of radiation with matter and scattering.

2. Course Main Objective

This course is designed to provide students with:
- the formulation of quantum mechanics that can be used in obtaining the first and second order energy and wave function corrections for nondegenerate and degenerate cases.
- the transition probabilities for two-level system using time-dependent perturbation theory, approximately obtain the lowest ground state energy by optimizing variational parameters of

the trial function, and generate scattering amplitudes and cross sections using Born approximation.

3. Course Learning Outcomes

	CLOs	Aligned PLOs
1	**Knowledge and Understanding**	
1.1	**Discuss** basics of the formulation of quantum theory	**PLO1.1**
1.2	**Describe** stimulated emission and spontaneous emission processes	**PLO1.1**
2	**Skills :**	
2.1	**Obtain** the transition probabilities for two-level system using time-dependent perturbation	**PLO2.2**
2.2	**Estimate** the lowest ground state energy using variational technique and the fact that the ground state energy is the lowest possible energy.	**PLO2.1**
2.3	**Calculate** the first and second order energy and wave function corrections	**PLO2.1**
2.4	**Derive** the first and second order energy and wave function corrections using time-independent perturbation techniques	**PLO2.2**
2.5	**Develop** communication and critical thinking competencies during interactive discussion, group assignments, essays or web-based activities	**PLO2.4**
3	**Values:**	
3.1	**Develop** skills of working in groups in group assignments and discussion and bear individual responsibility in the assigned tasks	**PLO3.1**

C. Course Content

No	List of Topics	Contact Hours
1	Short review of quantum formulation	**3**
2	Time-dependent perturbation theory	**9**
3	Time-independent perturbation theory	**9**
4	The Variational method	**9**
5	The WKB approximation	**6**
6	Born approximation (The Scattering theory).	**6**
7	Review	**3**
	Total	**45**

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge and Understanding**		
1.1	**Discuss** basics of the formulation of quantum theory	Lectures, discussion comparisons	**Direct** (formative and summative): In class interactive questioning, quizzes, written exams **Indirect:** student survey
1.2	**Describe** stimulated emission and spontaneous emission processes	Lectures, discussion	**Direct** (formative and summative): In class

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
			interactive questioning, quizzes, written exams **Indirect:** student survey
2.0	**Skills**		
2.1	**Obtain** the transition probabilities for two-level system using time-dependent perturbation	Lectures, discussion	**Direct** (formative and summative): In class interactive questioning, quizzes, written exams **Indirect:** student survey
2.2	**Estimate** the lowest ground state energy using variational technique and the fact that the ground state energy is the lowest possible energy.	Lectures, discussion, Tutorial	**Direct** (formative and summative): In class interactive questioning, quizzes, written exams **Indirect:** student survey
2.3	**Calculate** the first and second order energy and wave function corrections	Lectures, Discussion, Tutorial	**Direct** (formative and summative): In class interactive questioning, quizzes, written exams **Indirect:** student survey
2.4	**Derive** the first and second order energy and wave function corrections using time-independent perturbation techniques	Lectures, Discussion, Tutorial	**Direct** (formative and summative): In class interactive questioning, quizzes, written exams **Indirect:** student survey
2.5	**Develop** communication and critical thinking competencies during interactive discussion, group assignments, essays or web-based activities	Discussion, question and answer	**Direct** In class interactive questioning, quizzes, written exams **Indirect:** student survey
3.0	**Values**		
3.1	**Develop** skills of working in groups in group assignments and discussion and bear individual responsibility in the assigned tasks	Discussion, question and answer	**Direct** In class interactive questioning, quizzes, written exams **Indirect:** student survey

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	**Assignment 1**	**3**	**4** (4%)
2	**First Mid-term exam**	**6**	**10** (10%)
3	**Assignment 2**	**9**	**3** (3%)
4	**Second mid-term exam**	**10**	**15** (15%)
5	**Assignment-3**	**13**	**3** (3%)
6	**Third-mid term**	**14**	**15** (15%)
9	**Final Exam**	**16**	**50** (50%)

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student

consultations and academic advice :
Each group of students is assigned to a staff member who will be available for help and academic guidance office hours at specific 2h on daily basis.

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	**Introduction to quantum mechanics, David J. Griffiths, Printice Hall, 1995.**
Essential References Materials	**Introductory Quantum Mechanics; R. Liboff, 4th Edition, Addison-Wesely, 2002.** **• Quantum Mechanics; Sara M. McMurry, Addison-Wesely, 1994.**
Electronic Materials	www.wikipedia.org; quantummechanics.com ; quantum/Fayman.com
Other Learning Materials	

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	Class room
Technology Resources (AV, data show, Smart Board, software, etc.)	Data show- smart boar
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	None

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of teaching	Students, Peer and program leader	Indirect (CES)- Indirect peer evaluation
Assessment	Students, Program assessment committee	Direct/ Indirect
Extent of achievement of course learning outcomes	Instructor	Direct/Indirect
Quality of learning resources	Students, Faculty members	Indirect

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)
Evaluators (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

H. Specification Approval Data

Council / Committee	**Department council**
Reference No.	**8**
Date	**1442/4/16**

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

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2020

Course Specifications

Course Title:	**Plasma Physics**
Course Code:	**452PHYS**
Program:	**Physics**
Department:	**Physics**
College:	**Science**
Institution:	**Jazan University**

Table of Contents

A. Course Identification

1. Credit Hours: 3	
2. Course type	
a. University ☐ College ☐ Department ☑ Others ☐	
b. Required ☑ Elective ☐	
3. Level/year at which this course is offered: Level 8/ Year 4	
4. Pre-requisites for this course (if any)**: 353PHYS**	
5. Co-requisites for this course (if any)**: NIL**	

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	36	80%
2	Blended	9	20%
3	E-learning		
4	Distance learning		
5	Other		

7. Contact Hours (based on academic semester)

No	Activity	Contact Hours
1	Lecture	42
2	Laboratory/Studio	--
3	Tutorial	3
4	Others (specify)	
	Total	45

B. Course Objectives and Learning Outcomes

1. Course Description

This course is designed to provide students with the fundamentals of a Plasma as the fourth state of matter that incredibly important in basics sciences and technology. This course is an introductory course to plasma physics in which the plasma state and the basics plasma parameters and conditions are defined. Also in this course, the plasma models, the plasma oscillation, and wave phenomena in plasma are explained, in addition. The theory of gas discharge and the breakdown mechanism in plasma are illustrated, as well as the thermonuclear fusion reactions and criteria are given.

2. Course Main Objective

This course is designed to provide students with the following concepts:

1. The definition of plasma state, its main behavior and characteristics, the basics plasma parameters and some examples of plasma state in nature.
2. The plasma conditions and the relation between these conditions and the plasma behavior.
3. The single particle model and the motion of the charged particle in uniform electric and magnetic field.
4. The theory gas discharge and the breakdown mechanism in plasma experiments.
5. The thermonuclear fusion criteria and its rules in the fusion experiments.
6. Plasma diagnostics and plasma applications.

3. Course Learning Outcomes

	CLOs	Aligned PLOs
1	**Knowledge and Understanding**	
1.1	**State** plasma criteria, critical ignition temperature, confinement time for fusion, Lawson criterion, confinement schemes.	**PLO1.1**
1.2	**Define** plasma state, Debye length, quasi-neutrality, collective behavior, plasma frequency, plasma discharge, plasma breakdown, and nuclear fusion.	**PLO1.1**
1.3	**Explain** plasma experiments (Glow, and Arc discharge), Townsend discharge, plasma breakdown and the use of electric Probe for plasma diagnostics.	**PLO1.2**
2	**Skills :**	
2.1	**Solve** problems related to plasma criteria (Debye length, number of particle in Debye sphere, $\omega\tau$) , plasma density, average kinetic energy of particles in thermal equilibrium, cyclotron frequency, Larmor radius, confinement time, Lawson criterion for fusion reaction, temperature and density using electric probe as a diagnostic tool.	**PLO2.1**
2.2	**Derive** Debye length, average kinetic energy in thermal equilibrium, Cyclotron frequency, Larmor radius, drift velocity, plasma frequency, and breakdown condition.	**PLO2.2**
2.3	**Develop** competencies in communication and critical thinking.	**PLO2.4**
3	**Values:**	
3.1	**Develop** abilities of team work, bear individual responsibilities on assigned tasks.	**PLO3.1**
3.2	**Adopt** some practices of self and long life learning in the field of plasma and its important applications through some essays and case studies	**PLO3.2**

C. Course Content

No	List of Topics	Contact Hours
1	**Plasma State:** Plasma in nature**,** definition of Plasma **,** concept of temperature, Debye shielding, plasma parameters and conditions	**12**
2	**Plasma models:** The single particle model, and motion of single particle in uniform *E* and *B*.	**9**
3	**Waves in plasma:** The wave definition and representation**,** The phase and group velocity**,** The plasma oscillation, electron plasma wave**,** ion plasma (sound) waves**.**	**6**
4	**Gas discharge and breakdown:** Background (The gas discharge and its classifications)**,** The Direct current (DC) discharge, breakdown condition, Townsend, Glow and Arc discharges.	**6**
5	**Plasma experiments and diagnostics:** Introduction to controlled fusion reaction and Lawson criterion)**,** The magnetic confinement, The inertial confinement	**6**
6	**Plasma Diagnostics and plasma application** (elective)	**3**
7	**Review**	**3**
Total		**45**

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge and Understanding**		
1.1	**State** plasma criteria, critical ignition temperature, confinement time for fusion, Lawson criterion, confinement schemes.	Lectures, blackboard and visualization, group and interactive guided discussion, Interactive discussion	**Direct** (formative and summative): In class interactive questioning, quizzes, written exams **Indirect**: student survey
1.2	**Define** plasma state, Debye length, quasi-neutrality, collective behavior, plasma frequency, plasma discharge, plasma breakdown, and nuclear fusion.	Lectures, blackboard and diagram illustration, group discussion, Interactive illustrations- Student contribution	**Direct** (formative and summative): In class interactive questioning, quizzes, written exams **Indirect:** student survey
…	**Explain** plasma experiments (Glow, and Arc discharge), Townsend discharge, plasma breakdown and the use of electric Probe for plasma diagnostics.	Lectures, blackboard and visualization, brain storming, group and interactive discussion, Interactive illustration – Problem based learning	**Direct** (formative and summative): In class interactive questioning, quizzes, written exams **Indirect**: student survey
2.0	**Skills**		
2.1	**Solve** problems related to plasma criteria (Debye length, number of particle in Debye sphere, $\omega\tau$) , plasma density, average kinetic energy of particles in thermal equilibrium, cyclotron frequency, Larmor radius, confinement time, Lawson criterion for fusion reaction, temperature and density using electric probe as a diagnostic tool.	Lectures, blackboard and visualization, brain storming, group and interactive discussion, Interactive illustration – Problem based learning	**Direct** (formative and summative): In class interactive questioning, quizzes, written exams **Indirect**: student survey
2.2	**Derive** Debye length, average kinetic energy in thermal equilibrium, Cyclotron frequency, Larmor radius, drift velocity, plasma frequency, and breakdown condition.	Lectures, blackboard and visualization, brain storming, group and interactive discussion, Interactive illustration – Problem based learning	**Direct** (formative and summative): In class interactive questioning, quizzes, written exams **Indirect**: student survey
2.3	**Develop** competencies in communication and critical thinking.	Lectures, blackboard and visualization, brain storming, group and interactive discussion, Interactive illustration – Problem based learning	**Direct** (formative and summative): In class interactive questioning, quizzes, written exams **Indirect:** student survey
3.0	**Values**		
3.1	**Develop** abilities of team work, bear individual responsibilities on assigned tasks.	Interactive and Group discussion, expository and discovery teaching	**Direct** (formative and summative): In class interactive questioning **Indirect**: student survey

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
3.2	**Adopt** some practices of self and long life learning in the field of plasma and its important applications through some essays and case studies	Discussion - Brain storming -guided group analysis	**Direct** (formative): - essays assignment- case study) **Indirect**: student survey- viva

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Homework assignment- Contribution in interactive discussion- Group work or Project	3	2 (2%)
2	Lecture Quiz 1	4	5 (5%)
3	First Mid-term exam	6	15 (15%)
4	Homework assignment- Contribution in interactive discussion- Group work or Project	10	2 (2%)
5	Lecture Quiz 2	11	5 (5%)
6	Second mid-term exam	12	15 (15%)
7	Homework assignment- Contribution in interactive discussion- Group work-essay or Project discussion	11	4 (4%)
9	Final Exam	16	50 (50%)
1	Homework assignment- Contribution in interactive discussion- Group work or Project	3	2 (2%)

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice :

Each group of students is assigned to a staff member who will be available for help and academic guidance office hours at specific 2h on daily basis.

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	Introduction to Plasma Physics and Controlled Fusion; F. F. Chen, 3rd edition, Springer International Publishing Switzerland 2016.
Essential References Materials	- Fusion Research Principles, Experiments, and Technology, T. Dolan, Pergamum Press 2000. - Fundamentals of Plasma physics; Paul M. Bellan, Cambridge University Press, 2006. - Introduction to Plasma Physics; R.J. Goldston, P.H. Rutherford, Institute of Physics Publishing, London, 1997.
Electronic Materials	https://en.wikipedia.org/wiki/Plasma_(physics) https://www.iter.org https://www.britannica.com/science/plasma-state-of-matter https://www.cslplasma.com/what-is-plasma https://www.nap.edu/read/4936/chapter/10

Other Learning Materials	

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	Class room- if possible room for interactive discussion (round table)
Technology Resources (AV, data show, Smart Board, software, etc.)	Data show- smart board
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	None

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of teaching	Students, Peer and program leader	Indirect (CES)- Indirect peer evaluation
Assessment	Students, Program assessment committee	Direct/ Indirect
Extent of achievement of course learning outcomes	Instructor	Direct/Indirect
Quality of learning resources	Students, Faculty members	Indirect

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)
Evaluators (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

H. Specification Approval Data

Council / Committee	**Department council**
Reference No.	**8**
Date	**16/4/1442**

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

اعتماد NCAAA T4 2020

Course Specifications

Course Title:	**Nuclear Physics 1**
Course Code:	**461Phys**
Program:	**Physics**
Department:	**Physics**
College:	**Science**
Institution:	**Jazan University**

Table of Contents

A. Course Identification

1. Credit hours:								
2. Course type								
a.	University	☐	College	☐	Department	x	Others	☐
b.	Required	x	Elective	☐				
3. Level/year at which this course is offered: Level 7/ Year 4								
4. Pre-requisites for this course (if any)**: 352 PHYS**								
5. Co-requisites for this course (if any)**: NIL**								

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	36	80%
2	Blended	9	20%
3	E-learning		
4	Distance learning		
5	Other		

7. Contact Hours (based on academic semester)

No	Activity	Contact Hours
1	Lecture	42
2	Laboratory/Studio	--
3	Tutorial	3
4	Others (specify)	
	Total	45

B. Course Objectives and Learning Outcomes

1. Course Description

This course is to provide knowledge and understanding of the basics of nuclear physics like nuclear properties, nuclear force, nuclear structure, radioactivity, reactions and power production to enable progression to a postgraduate course or to provide a platform for entering industry.

2. Course Main Objective

This course is designed to provide students with:

- The fundamental of the nuclear physics and its scale.
- The basic properties of the nuclear force.
- The structure of the nucleus under different nuclear models.
- The stability of nuclei and their decay.
- The fission process and the basics of nuclear reactor.
- The fusion process and how intermediate and heavy elements are created in the stars.

3. Course Learning Outcomes

CLOs	Aligned

		PLOs
1	**Knowledge and Understanding**	
1.1	**Define:** The atomic number Z – the mass number – Isotopes – isobars – isotones - atomic mass unit- The binding energy - the Q-value – half life time-decay constant – cross section – reaction rate – flux	**PLO1.1**
1.2	**Describe:** Nuclear structure, nuclear volume and nuclear density, nuclear angular momentum, nuclear electric quadrupole moment – nuclear force – shell model – liquid drop model – fermi gas model- alpha decay – beta decay – gamma decay – carbon dating – compound nucleus – nuclear reactor	**PLO1.1**
1.3	**Discuss** excited states and stability, nuclear reaction, nuclear fission, nuclear fusion.	**PLO1.2**
2	**Skills :**	
2.1	**Calculate** binding energy and mass defect, atomic weight, nuclear force, nuclear density, angular momentum, Q-value, nuclear energy	**PLO2.2**
2.2	**Solve** the problems related with radioactive decay	**PLO2.1**
2.3	**Evaluate** liquid drop model, shell model, nuclear force and exchange force	**PLO2.1**
2.4	**Develop** communication and critical thinking competencies during interactive discussion, group assignments, essays or web-based activities	**PLO2.4**
3	**Values:**	
3.1	**Show** effective collaboration and bear individual responsibility during group work and/or assignments	**PLO3.1**

C. Course Content

No	List of Topics	Contact Hours
1	**Nuclear Properties:** Nuclear scale, units, size and density, quadrupole moment, Notation, isotopes, The nuclear chart (Nuclear landscape), how to write a nuclear reaction, Binding Energy BE, Q-value.	**12**
2	**Nuclear forces:** exchange force, proton potential well and neutron potential wells, nuclear force.	**6**
3	**Nuclear models:** Fermi gas model, Liquid drop model, Shell model, deformation.	**9**
4	**Radioactivity:** Types of radiation,- Alpha , - Beta+ , Beta-, - Gamma, Electron capture, decay chains, Uses of Radioactivity, Radioactivity decay law, Half-life, life time, nuclear dating, Carbon, Rock dating	**6**
5	**Nuclear reactions:** The conservation laws, types of reaction, Elastic, Inelastic, Transfer, Compound, Fission, why fission happens, spontaneous, induced (controlled), nuclear reactor., Fusion, p-p cycle, CNO cycle, nucleosynthesis.	**9**
6	**Review**	**3**
	Total	45

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge and Understanding**		
1.1	**Define:** The atomic number Z – the mass number – Isotopes – isobars – isotones - atomic mass unit- The binding energy - the Q-value – half life time-decay constant – cross section – reaction rate –	Lectures, discussion	Quizzes, mid-term exams

	flux		
1.2	**Describe:** Nuclear structure, nuclear volume and nuclear density, nuclear angular momentum, nuclear electric quadrupole moment – nuclear force – shell model – liquid drop model – fermi gas model- alpha decay – beta decay – gamma decay – carbon dating – compound nucleus – nuclear reactor	Lectures, discussion	Quizzes, mid-term exams
1.3	**Discuss** excited states and stability, nuclear reaction, nuclear fission, nuclear fusion.	Lectures, discussion	Quizzes, mid-term exams
2.0	**Skills**		
2.1	**Calculate** binding energy and mass defect, atomic weight, nuclear force, nuclear density, angular momentum, Q-value, nuclear energy	Lectures, discussion	Quizzes, mid-term exams and final exam
2.2	**Solve** the problems related with radioactive decay	Lectures, discussion	Quizzes, mid-term
2.3	**Evaluate** liquid drop model, shell model, nuclear force and exchange force	Lectures, discussion	exams and final exam
2.4	**Develop** communication and critical thinking competencies during interactive discussion, group assignments, essays or web-based activities	Lectures, discussion	exams and final exam
3.0	**Values**		
3.1	**Show** effective collaboration and bear individual responsibility during group work and/or assignments	Individual and group practices-Brain storming – free related small web-based topics	Case study- reports-project work-presentation

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	**Homework assignment 1**	**2**	**6**
2	**Homework assignment 2**	**4**	**2**
3	**1st Mid-term Exam**	**6**	**20**
4	**Homework assignment 3**	**10**	**2**
5	**2nd Mid-term Exam**	**12**	**20**
6	**Final Exam**	**16**	**50**

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice :

Each group of students is assigned to a staff member who will be available for help and academic guidance office hours at specific 2h on daily basis.

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	Introductory Nuclear Physics, Krane K.S. Wiley, New York, (1987).
Essential References Materials	Nuclear and Particle Physics, Williams W.S.C Clarendon Press, Oxford, (1991).
Electronic Materials	http://hyperphysics.phy-astr.gsu.edu **http://www.wikipedia.org/**
Other Learning Materials	

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	**1 Lecture room(s) for groups of 50 students.**
Technology Resources (AV, data show, Smart Board, software, etc.)	**1 Computer laboratories each for groups of 25 students.**
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of teaching	Students, Peer and program leader	Indirect (CES)- Indirect peer evaluation
Assessment	Students, Program assessment committee	Direct/ Indirect
Extent of achievement of course learning outcomes	Instructor	Direct/Indirect
Quality of learning resources	Students, Faculty members	Indirect
Strategies for Obtaining	Student Feedback	Student assessment of Teaching Quality (NCAAA form).
Processes for Improvement of Teaching	Faculty members	Revision of course contents, course specifications, and teaching strategies every 5 years.
Processes for Verifying Standards of Student Achievement	independent member teaching staff of a sample of student work, periodic exchange and remarking of tests or a sample of	Check marking by an independent staff member of a sample of student work. Periodic exchange and check marking of a sample of

	assignments with staff at another institution)	assignments with a staff member in another institution.

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)
Evaluators (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

H. Specification Approval Data

Council / Committee	**Council of Physics Department**
Reference No.	8
Date	16/4/1442

Course Specifications

Course Title:	**Nuclear Physics II**
Course Code:	**462PHYS**
Program:	**Physics**
Department:	**Physics**
College:	**Science**
Institution:	**Jazan University**

Table of Contents

A. Course Identification

1. Credit hours: 4	
2. Course type	
a. University ☐ College ☐ Department ☑ Others ☐	
b. Required ☑ Elective ☐	
3. Level/year at which this course is offered: $8^{th}/4^{th}$	
4. Pre-requisites for this course (if any)**:** **Nuclear Physics I (461PHYS)**	
5. Co-requisites for this course (if any)**:** **NIL**	

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	**Traditional classroom**	**42**	**46.6 %**
2	**Blended**	**6**	**6.8 %**
3	**E-learning**		
4	**Distance learning**		
5	**Other**	**42**	**46.6%**

7. Contact Hours (based on academic semester)

No	Activity	Contact Hours
1	**Lecture**	**45**
2	**Laboratory/Studio**	**45**
3	**Tutorial**	**-**
4	**Others** (Problem Solving Sessions, Quizzes, Office Hours)	**50**
	Total	**140**

B. Course Objectives and Learning Outcomes

1. Course Description

This is an advanced course offered to the 8th level undergraduate senior students at the Jazan University, to complete their basic training in nuclear and particle physics (in continuation with the 461PHYS course). This is a comprehensive and quite involved course which covers interaction of particles and radiation with matter (via energy loss in media), particle detectors, particle accelerators, particle families and the standard model, as the main chapters in this course. The learning outcome of this course are to get students acquainted with the particle types and their interactions (based on their identifications, charge and mass, such as electron, proton, alpha, photon etc.) with matter. These interactions are measured by an electronic device named as detector. Students learn the theoretical aspects of detector physics and their development and how they work. In order to produce the particles in the laboratory we need high-energy particle accelerators. Students are taught the basic design of these accelerators and their working principles and mechanisms. Students also learn the elementary particles based on their spin, charge, mass and lifetime. Finally they will learn the Standard Model briefly that describes the elementary particles and their fundamental interactions (under the framework of QED, EW and QCD theories) that shape our known universe. Students are also required to perform the practical classes (labs) concerning the course contents.

2. Course Main Objective

This course is designed to provide students with:

- The fundamentals of particle and radiation interaction with matter, particle detection, acceleration, particle zoo and the standard model of elementary particles.
- Knowledge of how the particle detectors and accelerators are designed and familiarity with the modern cutting edge technologies as well as advanced research in nuclear and particle physics fields.
- Explanation particle classifications and the corresponding theoretical model.
- Demonstration of concepts concerning the course by means of practical classes.

3. Course Learning Outcomes

	CLOs	Aligned PLOs
1	**Knowledge and Understanding**	
1.1	**Define** Bethe-Bloch formula, definition of the Standard Model (SM), CPT Theorem, Gell-Mann-Nishijima Formula, Bremsstrahlung, cross section, stopping power/energy loss.	**PLO1.1**
1.2	**Describe** charged particle interaction pathways, photon interaction with matter, neutron interaction with matter; various ionization/ scintillation/semiconductor/calorimeter detectors, Photomultiplier tube and Geiger-Mueller counter; weak & electromagnetic interactions, quark content of mesons and baryons, principles of electrostatic and resonance accelerators; charge, spin, strangeness in particle decay, and violation of quantum number in the radioactive decays, symmetries, and color quantum number.	**PLO1.1**
1.3	**Discuss** Quark model for mesons and baryons, ionization, scintillation, time of flight, parity, QCD (Quantum Chromodynamics) and confinement, charge, spin, strangeness in particle decay, and violation of quantum number in the radioactive decays, symmetries, and color quantum number.	**PLO1.2**
2	**Skills:**	

	CLOs	Aligned PLOs
2.1	**<u>Solve</u>** problems in particles energy and range in the collision with matter, photoelectric effect, Compton effect, pair production, flight time and the corresponding velocities for particles in collisions, FWHM, range of alpha and beta in media, and Lorentz force calculation.	**PLO2.1**
2.2	**<u>Demonstrate</u>** centre of mass energy in the colliding beams, the Baryon Octet and Decuplet symmetries with examples, plotting a GM plateau, plotting a γ spectrum, Inverse Square Law. Show competencies in communication, critical thinking and reporting during lab work, interactive discussion and group assignments.	**PLO2.2**
2.3	**<u>Perform</u>** laboratory experiments included in this course.	**PLO2.3**
2.4	**<u>Develop</u>** competency in understanding detector, accelerator and particle classifications based on their generation and properties.	**PLO2.4**
3	**Values:**	
3.1	**<u>Show</u>** the paradigm of collaboration with effective collaboration, demonstrating the important skills to work in groups, while taking responsibility for individual tasks during group assignments and lab work and practice safety awareness in the lab.	**PLO3.1**

C. Course Content

No	List of Topics	Contact Hours
1	**Energy Deposition in Media:** - Introduction - Charged particles interaction with matter - Bethe Bloch formula - Energy loss through bremsstrahlung - Photon interaction with matter - Photoelectric, Compton and pair production mechanism - Interaction of neutrons with matter - Interaction of hadrons with matter (briefly)	**10**
2	**Particle Detection:** - Introduction - Ionization detectors - Ionization counters, proportional counters and Geiger Muller counters - Scintillation detectors - Time of Flight - Cherenkov detectors - Semiconductor detectors - Calorimeters - Layer detectors (e.g. ATLAS, CMS at CERN)	**10**
3	**Accelerators:** - Introduction - Electrostatic accelerators - Resonance accelerators	**6**

	- Synchronous accelerators - Phase stability, strong focusing and colliding beam - Large Hadron Collider at CERN (basic information from web)	
4	**Properties and Interactions of Elementary Particle:** -Introduction - Four basic forces -Elementary particles (their history) -Quantum number (Baryon, lepton, strangeness, isospin etc.) -Gell-Mann_Nisjijima relation - Production and decay of resonances - Violation of quantum numbers - Weak interaction (Hadrinic weak decays, semileptonic processes etc.) - Electromagnetic interaction - Symmetries - Parity - Time Reversal - CPT theorem -	**12**
5	**Formulation of the Standard Model:** -Introduction - Quarks and leptons - Quark content of mesons - Quark content of baryons - Color quantum number - Quark model for mesons and baryons - Valance and sea quarks in hadrons - Chromodynamics and confinement	**4**
6	Review	**3**
	Total	45

Experimental Part:

No	List of Topics	Contact Hours
1	Plotting a GM Plateau	3
2	Geiger Tube Efficiency	3
3	Inverse Square Law	**3**
4	Absorption of Gamma Rays	**3**
5	Backscattering of Gamma Rays	3
6	Determining the half-life of Ba-137	3
7	Recording and calibrating a γ spectrum	3
8	Detection Efficiency of a NaI(Ti) Detector	3
9	Calculation of β/Υ ratio	**3**
	Total	**27**

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge and Understanding**		
1.1	**Define** Bethe-Bloch formula, definition of the Standard Model (SM), CPT Theorem, Gell-Mann-Nishijima Formula, Bremsstrahlung, cross section, stopping power/energy loss.	Lectures, blackboard and visualization, group and interactive guided discussion, Interactive discussion	**Direct:** (formative and summative): In class interactive questioning, quizzes, written exams **Indirect:** student survey
1.2	**Describe** charged particle interaction pathways, photon interaction with matter, neutron interaction with matter; various ionization/ scintillation/semiconductor/calorimeter detectors, Photomultiplier tube and Geiger-Mueller counter; weak & electromagnetic interactions, quark content of mesons and baryons, principles of electrostatic and resonance accelerators.	Lectures, blackboard and visualization, group and interactive guided discussion, Interactive discussion	**Direct:** (formative and summative): In class interactive questioning, quizzes, written exams **Indirect:** student Survey
1.3	**Discuss** Quark model for mesons and baryons, ionization, scintillation, time of flight, parity, QCD (Quantum Chromodynamics) and confinement, charge, spin, strangeness in particle decay, and violation of quantum number in the radioactive decays, symmetries, and color quantum number.	Lectures, blackboard and visualization, group and interactive guided discussion, Interactive discussion, Colored ball and stick model for quark model visualization	**Direct:** (formative and summative): In class interactive questioning, quizzes, written exams **Indirect:** student survey
2.0	**Skills**		
2.1	**Solve** problems in particles energy and range in the collision with matter, photoelectric effect, Compton effect, pair production, flight time and the corresponding velocities for particles in collisions, FWHM, range of alpha and beta in media, and Lorentz force calculation.	Lectures, blackboard and visualization, brainstorming, group and interactive discussion, Interactive illustration, Problem-based Learning	**Direct:** (formative and summative): In class interactive questioning, quizzes, written exams **Indirect:** student Survey
2.2	**Demonstrate** centre of mass energy in the colliding beams, the Baryon Octet and Decuplet symmetries with examples, plotting a GM plateau, plotting a γ spectrum, Inverse Square Law. Show competencies in communication, critical thinking and	Lab work and demonstrations, Blackboard lectures and visualization, group and interactive guided discussion, Interactive discussion.	**Direct:** (formative and summative): In class interactive questioning, quizzes, written exams **Indirect:** student

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
	reporting during lab work, interactive discussion and group assignments.	Movies, Group Assignments	survey
2.3	**Perform** laboratory experiments included in this course.	Lab Lectures, Blackboard lectures and visualization, brainstorming, group and interactive discussion, Interactive illustration, Problem-based Learning	**Direct:** (formative and summative): In class interactive questioning, quizzes, written exams **Indirect:** student Survey
2.4	**Develop** competency in understanding detector, accelerator and particle classifications based on their generation and properties.	Lectures, blackboard and visualization, brainstorming, group and interactive discussion, Interactive illustration, Problem-based Learning	**Direct:** (formative and summative): In class interactive questioning, quizzes, written exams **Indirect:** student Survey
3.0	**Values**		
3.1	**Show** the paradigm of collaboration with effective collaboration, demonstrating the important skills to work in groups, while taking responsibility for individual tasks during group assignments and lab work and practice safety awareness in the lab.	Interactive and Group discussion, expository and discovery teaching	**Direct:** (formative and summative): In class interactive questioning, quizzes, written exams **Indirect:** student Survey

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Homework assignment- Contribution in interactive discussion	3	2 (2%)
2	Quiz 1	4	2 (2%)
3	First Mid-term exam	7	8 (8%)
4	Quiz 2	8	1 (1%)
5	Homework assignment- Contribution in interactive discussion	9	2 (2%)
6	Second mid-term exam	11	8 (8%)
7	Homework assignment- Contribution in interactive discussion- Group work-essay or Project discussion	12	2 (2%)
8	Laboratory Examination	14	25(25%)
9	Final Examination	16	50(50%)

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student

consultations and academic advice :
Each group of students is assigned to a staff member who will be available for help and academic guidance office hours at specific 2hours on daily basis.

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	**Introduction to Nuclear and Particle Physics; A. Das and T. Ferbel (World Scientific Publishing, 2005).**
Essential References Materials	Radiation Detection and Measurement; G. Knoll (John Wiley & Sons, 2000). Nuclear Physics; Irving Kaplan (Addison-Wesley Publishing Company, Cambridge, Mass, 1962).
Electronic Materials	Particle Data Book (Online): http://pdg.lbl.gov
Other Learning Materials	CERN http://cern.ch JLab http://jlab.org

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	Class Room
Technology Resources (AV, data show, Smart Board, software, etc.)	Multi-Media Projector
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	Nuclear Physics Laboratory

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of teaching	Students, Peers and Program Leader	Indirect (CES)- Indirect peer evaluation
Assessment	Students, Program assessment committee	Direct/Indirect
Extent of achievement of course learning outcomes	Instructor	Direct/Indirect
Quality of learning resources	Students, Faculty members	Indirect (CES)- Indirect peer evaluation

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)
Evaluators (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

H. Specification Approval Data

Council / Committee	**Department council**
Reference No.	**8**
Date	**16/4/1442**

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

اعتماد
NCAAA
T4
2020

Course Specifications

Course Title:	**Solid State Physics 2**
Course Code:	**471 PHYS**
Program:	**Physics**
Department:	**Physics**
College:	**Science**
Institution:	**Jazan University**

Table of Contents

A. Course Identification

1. Credit hours:							
2. Course type							
a.	University ☐	College ☐	Department ☑ √	Others ☐			
b.	Required √	Elective ☐					
3. Level/year at which this course is offered: Level 8 / Year 4							
4. Pre-requisites for this course (if any)**: Solid State Physics 1 (371 PHYS)**							
5. Co-requisites for this course (if any)**: NIL**							

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	42	46.6 %
2	Blended	6	6.8 %
3	E-learning		
4	Distance learning		
5	Other	42	46.6 %

7. Contact Hours (based on academic semester)

No	Activity	Contact Hours
1	Lecture	45
2	Laboratory/Studio	45
3	Tutorial	0
4	**Others** (specify): Preparations for various assignments, quizzes, exams, office Hours.	50
	Total	**140**

B. Course Objectives and Learning Outcomes

1. Course Description

This course is a continuation of the solid-state physics 1 course. In its first part, it covers quantum approach of free electron theory of solids and band theory of solids. The second part deals with the semiconductor physics theory and applications which cover energy bands and carrier concentrations in semiconductors at equilibrium and carrier transport phenomena, dielectrics and ferroelectric materials.

2. Course Main Objective

This course is designed to provide students by knowledge about:

- The basic concepts of quantum mechanics and statistical mechanics.
- Free electron theory according to the quantum theory.
- Band theory of solids, Bloch theorem and Kronig-Penny model.
- Classification of solids according to their band gabs.
- Semiconductors and conduction mechanisms.

- Dielectrics and ferroelectric materials.
- Experiments related to the above topics.

3. Course Learning Outcomes

	CLOs	Aligned PLOs
1	**Knowledge and Understanding**	
1.1	**Define:** Electrical parameters of conductors and semiconductors, Fermi-Dirac distribution function, density of states, degeneracy, Fermi Level, Fermi energy, Mobility, Relaxation Time, Mean collision time, Mean free path, Brillouin zone, effective mass of the electron, Energy Gap, valence and conduction band edge, intrinsic and extrinsic semiconductors, drift current and holes, doping, acceptor and donor states, Peltier coefficient, thermoelectric power, Dielectric Properties of Solids, Dipole moment, Dielectric Properties of Solids, Dielectric constant and polarizability, polarization, electrical susceptibility, piezoelectricity, Ferroelectricity, and curie temperature.	**PLO 1.1**
1.2	**Describe:** Ohm's law based on quantum free electron theory, Weidman-Franz law, Bloch theorem, Pauli exclusion principle Matthiessen's rule, Fermi-Dirac distribution function and Clausius-Mossotti relation.	**PLO 1.1**
1.3	**Discuss**: Free electron fermi gas theory, band theory of solids, Hall effect, Sources of electrical resistances, effective mass of electrons, origin of the band gab, Bloch theorem, Kronig Penny model, direct and indirect absorption process, intrinsic and extrinsic semiconductors, thermoelectric effects, degenerate and non-degenerate semiconductors, conduction mechanism in semiconductors, Lorentz field, different types of polarizability, polarization mechanism in dielectric materials, and hysteresis loop of a ferroelectric material, source of piezoelectricity.	**PLO 1.2**
1...		
2	**Skills :**	
2.1	**Solve**: problems related to electrical conduction, heat capacity and thermal conductivity in metals, drift velocity, mean free path, mean thermal velocity, relaxation time, Hall coefficient, Fermi Dirac distribution, semiconductors and dielectrics, concentration of charge carriers in semiconductors, Fermi energy, relative permittivity, dielectric constant, electric susceptibility, electric polarization, polarizability.	**PLO 2.1**
2.2	**Derive** Expressions for the electronic specific heat of metals, density of state, effective mass of the electron, electrical conductivity of metals and semiconductors, charge carriers, position of Fermi levels in different types of semiconductors and dielectric parameters, equations of motion in crystals.	**PLO 2.2**
2.3	**Perform:** some experiments to justify and prove different phenomena related to the course contents.	**PLO 2.3**
2.4	**Develop** competencies in critical thinking, analyzing the obtained data, communication and writing lab reports.	**PLO 2.4**
3	**Values:**	
3.1	**Develop** ability to work in groups and bear individual responsibility during lab work, interactive discussion and group assignments.	**PLO3.1**
3.2	**Demonstrate** awareness of safety for own and others competencies during lab work.	**PLO3.3**

	CLOs	Aligned PLOs
3...		

C. Course Content

Theoretical Part

No	List of Topics	Contact Hours
1	**Free Electron Fermi Gas:** - ENERGY LEVELS IN ONE DIMENSION - EFFECT OF TEMPERATURE ON THE FERMI-DIRAC DISTRIBUTION - FREE ELECTRON GAS IN TIIREE DIMENSIONS - ELECTRICAL CONDUCTIVITY AND OHM'S LAW - MOTION IN MAGNETIC FIELDS Hall effect - THERMAL CONDUCTIVITY OF METALS Ratio of thermal to electrical conductivity	**9**
2	**Energy Bands** - NEARLY FREE ELECTRON MODEL: Origin of the energy gap Magnitude of the energy gap - BLOCH FUNCTIONS - EQUATION OF ELECTRON IN A PERIODIC POTENTIAL Restatement of the Bloch theorem Crystal momentum of an electron Solution of the central equation Kronig-Penney model in reciprocal space - NUMBER OF ORBITALS IN A BAND Metals and insulators	**9**
3	**Semiconductor Crystals** - EQUATIONS OF MOTION Physical derivation of **hk** = F Holes Effective mass Physical interpretation of the effective maw Effective masses in semiconductors - INTRINSIC CARRIER CONCENTRATION Intrinsic mobility - IMPURITY CONDUCTIVITY Donor states Acceptor states Thermal ionization of donors and acceptors - THERMOELECTRIC EFFECTS SEMIMETALS	**12**
4	**Dielectrics and Ferroelectrics** - MACROSCOPIC ELECTRIC FIELD Depolarization field, E, - LOCAL ELECTRIC: FIELD AT AN ATOM Lorentz field, E, Field of dipoles inside cavity, E, - DIELECTRIC CONSTANT AND POLARIZABILITY Electronic polarizability Classical theory - STRUCTURAL PHASE TRANSITIONS - FERROELECTRIC CRYSTALS Classification of ferroelectric crystals Ferroelectric hysteresis Ferroelectric domains Piezoelectricity	**9**

5	Review, Homework correction, Midterm exams	**6**
...		
Total		**45**

Experimental Part:

No	List of Topics	Contact Hours
1	**Determination of Seebeck coefficients of thermocouples.**	**3**
2	**Linear absorption coefficient of dielectric material.**	**3**
3	**Solar cell characteristics.**	**3**
4	**Detection of X-rays using an ionization chamber.**	**3**
5	**Carrier concentration of metal using Hall Effect.**	**3**
6	**Electrical characteristics of semiconductor photo-resistor.**	**3**
7	**Planck constant using light emitting diodes.**	**3**
8	**Determination of the band gap of a semiconductor by four Probe method.**	**3**
9	**Boltzmann Constant Using a PN Junction Diode**	**3**
10	**Noble-metal resistor and a Semiconductor resistor as a function of the temperature**	**3**
11	**Ferromagnetic hysteresis**	**3**
12	**Introduction, review, and various exams**	**12**
Total		**45**

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge and Understanding**		
1.1	**Define:** Electrical parameters of conductors and semiconductors, Fermi-Dirac distribution function, density of states, degeneracy, Fermi Level, Fermi energy, Mobility, Relaxation Time, Mean collision time, Mean free path, Brillouin zone, effective mass of the electron, Energy Gap, valence and conduction band edge, intrinsic and extrinsic semiconductors, drift current and holes, doping, acceptor and donor states, Peltier coefficient, thermoelectric power, Dielectric Properties of Solids, Dipole moment, Dielectric Properties of Solids, Dielectric constant and polarizability, polarization, electrical susceptibility, piezoelectricity, Ferroelectricity, and curie temperature.	Lectures, Open discussion, interactive comparisons, Question-answer method	**Direct**: Homework assignment, Quizzes, mid-term and final exam **Indirect**: student survey
1.2	**Describe:** Ohm's law based on quantum free electron theory,	Lectures, Open discussion, interactive	**Direct**: Homework assignment,

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
	Weidman-Franz law, Bloch theorem, Pauli exclusion principle Matthiessen's rule, Fermi-Dirac distribution function and Clausius-Mossotti relation.	comparisons, Question-answer method	Quizzes, mid-term exam and final exam **Indirect**: student survey
1.3	**<u>Discuss</u>**: Free electron fermi gas theory, band theory of solids, Hall effect, Sources of electrical resistances, effective mass of electrons, origin of the band gab, Bloch theorem, Kronig Penny model, direct and indirect absorption process, intrinsic and extrinsic semiconductors, thermoelectric effects, degenerate and non-degenerate semiconductors, conduction mechanism in semiconductors, Lorentz field, different types of polarizability, polarization mechanism in dielectric materials, and hysteresis loop of a ferroelectric material, source of piezoelectricity.	Lectures, Open discussion, interactive comparisons, Question-answer method	**Direct**: Homework assignment, Quizzes, mid-term exam and final exam **Indirect**: student survey
2.0	**Skills**		
2.1	**<u>Solve</u>**: problems related to electrical conduction, heat capacity and thermal conductivity in metals, drift velocity, mean free path, mean thermal velocity, relaxation time, Hall coefficient, Fermi Dirac distribution, semiconductors and dielectrics, concentration of charge carriers in semiconductors, Fermi energy, relative permittivity, dielectric constant, electric susceptibility, electric polarization, polarizability.	Lectures, Open discussion, interactive comparisons. Brain storming	**Direct**: Homework assignment, Quizzes, mid-term exam and final exam **Indirect**: student survey
2.2	**<u>Derive</u>** Expressions for the electronic specific heat of metals, density of state, effective mass of the electron, electrical conductivity of metals and semiconductors, charge carriers, position of Fermi levels in different types of semiconductors and dielectric parameters, equations of motion in crystals.	Lectures, Open discussion, interactive comparisons, individual solving problem.	**Direct**: Homework assignment, Quizzes, mid-term exam and final exam **Indirect**: student survey
2.3	**<u>Perform:</u>** some experiments to justify and prove different phenomena related to the course contents.	demonstrations of laboratory equipment and experiments- Hands-on lab work	**Direct**: Direct evaluation of assignments, Step-by-step checkpoint

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
			assessment of experiment, Final Practical Exam. **Indirect**: student survey
2.4	**Develop** competencies in critical thinking, analyzing the obtained data, communication and writing lab reports.	Interactive discussion-Case study, group assignment, open discussion, individual presentation.	**Direct**: Observation questioning, Discussion, individual presentation. **Indirect**: student survey
2.5			
3.0	**Values**		
3.1	**Develop** the ability to work in groups and bear individual responsibility during lab work, interactive discussion and group assignments.	Group discussion during the lecture and in the lab, Direct evaluation	**Direct**: Observation questioning, discussion **Indirect**: student survey
3.2	**Demonstrate** awareness of safety for own and others competencies during lab work.	Lab work- guidelines, Safety presentation in the first lab lectures.	**Direct**: Observation questioning, discussion, **Indirect**: student survey
3.3			

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	**Homework Assignment**	**2,5,8,10**	**4%**
2	**Lecture Quizzes 1,2**	**3,9**	**4%**
3	**First Mid-term exam**	**6**	**8%**
4	**Second Mid-term exam**	**11**	**7%**
5	**Contribution in interactive discussion- Group work-essay or Project discussion Lecture web-based essay.**	**12**	**2%**
6	**Lab Report, communication, group work and lab safety competence**	**14**	**10%**
7	**Practical exam**	**14**	**15%**
8	**Final Exam**	**16**	**50%**

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice : **Each group of students is assigned to a staff member who will be available for help and academic guidance office hours at specific 2h on daily basis.**

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	**Introduction to Solid States; C. Kittel, 7th Edition, John-Wiley and Sons Inc., 1997.**
Essential References Materials	• **Principles of the Solid State; H. V. Keer, Wiley Eastern Limited, London, 1993.** • **The Solid State; H. M. Rosenberg, Oxford press, 1988.**
Electronic Materials	**http://ocw.mit.edu/courses/physics/** **http://www.physics.org/explore.asp** **https://web.njit.edu/~sirenko/Phys-446/PHYS446SSP.htm**
Other Learning Materials	

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	**1 Lecture room(s) for 30 students.** **1 Laboratory for 15 students.**
Technology Resources (AV, data show, Smart Board, software, etc.)	**Data show- smart board**
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	**Library**

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of teaching	Students, Peer and program leader	Indirect (CES)- Indirect peer evaluation
Assessment	Students, Program assessment committee	Direct/ Indirect
Extent of achievement of course learning outcomes	Instructor	Direct/Indirect
Quality of learning resources	Students, Faculty members	Indirect
Effectiveness of teaching	Students, Peer and program leader	Indirect (CES)- Indirect peer evaluation

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)
Evaluators (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

H. Specification Approval Data

Council / Committee	Department council
Reference No.	8
Date	16/4/1442

هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

Course Specifications

Course Title:	**Graduation Project**
Course Code:	**491PHYS**
Program:	**Physics**
Department:	**Physics**
College:	**Science**
Institution:	**Jazan University**

Table of Contents

A. Course Identification

1. Credit hours: 2								
2. Course type								
a.	University	☐	College	☐	Department	v	Others	☐
b.	Required	v	Elective	☐				
3. Level/year at which this course is offered: Level7/Year4								
4. Pre-requisites for this course (if any)**: Department agreement**								
5. Co-requisites for this course (if any)**:NIL**								

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	**Traditional classroom**		
2	**Blended**	20	55.55%
3	**E-learning**		
4	**Distance learning**	5	
5	**Other (lab)**	20	44.45%

7. Contact Hours (based on academic semester)

No	Activity	Contact Hours
1	**Lecture**	--
2	**Laboratory/Studio**	30
3	**Tutorial**	--
4	**Others** (specify) (specify)- Research project	15
	Total	45

B. Course Objectives and Learning Outcomes

1. Course Description

Graduation project leading to BSc may take a number of different forms. It might involve carrying out a small experimental investigation, involving the use of laboratory facilities and underpinned by a review of previous works in the same theme. The project could be a computational programming work, consisting of a small numerical simulation of special physics phenomena. In this case the attention should focus on the computational technique and its effectiveness of describing the phenomena. The project could even consist on a detailed literature review in a particular subject, but it would need to be critical and theoretical in its approach and involve much more research than a long essay.

2. Course Main Objective

This course is designed to provide students with:

- Develop the students' research work experience supervised by a faculty member
- Provide the possibility to expand students' knowledge in a specific area
- Develop or implement experimental, computational or theoretical work to enhance student's scientific abilities.
- Prepare students for effective writing and presentation skills.
- Train the students with opportunities of self-confidence effectively communicate the results to an audience.

3. Course Learning Outcomes

	CLOs	Aligned PLOs
1	**Knowledge and Understanding**	
1.1	**Identify** and utilize relevant previous work that supports their research	**PLO1.1**
1.2	**Discuss** prior knowledge and learning of concepts, theories and principles related to the project task.	**PLO1.2**
2	**Skills :**	
2.1	**Apply** fundamental concepts and problem solving skills to constructively address research setbacks.	**PLO2.1**
2.2	**Demonstrate** analytical skills and competencies to formulate, drive and analyze physics concepts related to the area of research	**PLO2.2**
2.3	**Apply** experimental, Theoretical calculation or numerical simulation methods to solve a given scientific task.	**PLO2.3**
2.4	**Analyze** data and synthesize research findings creatively through sustained critical investigation.	**PLO2.4**
2.5	**Report** research findings in both written and verbal forms.	**PLO2.4**
3	**Values:**	
3.1	**Demonstrate** capacity to work both independently and in collaboration with others to lead and manage the research work.	**PLO3.1**
3.2	**Practice** the skills, diligence, and commitment to excellence needed to engage in lifelong learning.	**PLO3.2**
3.3	**Demonstrate** an awareness and application of appropriate personal, societal, and professional ethical standards.	**PLO3.3**
3.4		
3.5		

C. Course Content

No	List of Topics	Contact Hours
1	Literature review	**4**
2	Analysis and discussion of the problem	**2**
3	Application of the approaches	**4**
4	Practical research and/or Numerical simulation and/or theoretical calculations in the chosen topic	**15**
5	Results analysis and discussion	**10**
6	Writing a research report	**6**
7	Presenting and discussing the research project	**4**
	Total	**45**

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge and Understanding**		
1.1	**Identify** and utilize relevant previous work that supports their research	Group and interactive guided discussion, Interactive discussion Literatures collecting	**Direct** (formative and summative): Written report, Viva voce. **Indirect**: student survey, Presentation
1.2	**Discuss** prior knowledge and learning of concepts, theories and principles related to the project task.	Diagram illustration, group discussion, Interactive illustrations- Student contribution	**Direct** (formative and summative): Written report, Viva voce. **Indirect:** student survey, Presentation
2.0	**Skills**		
2.1	**Apply** fundamental concepts and problem solving skills to constructively address research setbacks.	Diagram illustration, group discussion, Interactive illustrations- Student contribution	**Direct** (formative and summative): Written report, Viva voce. **Indirect**: student survey¸ Presentation
2.2	**Demonstrate** analytical skills and competencies to formulate, drive and analyze physics concepts related to the area of research	Diagram illustration, group discussion, Interactive illustrations.	**Direct** (formative and summative): Written report, Viva voce. **Indirect**: student survey, Presentation
2.3	**Apply** experimental, Theoretical calculation or numerical simulation methods to solve a given scientific task.	Individual and group Hands on experiment, numerical simulation, theoretical Calculation, Data analysis, Results Discussion.	**Direct** (formative and summative): Written report, Viva voce. **Indirect:** student survey, Presentation
2.4	**Analyze** data and synthesize research findings creatively through sustained critical investigation.	Individual and group data analysis, Results Discussion.	**Direct** Written report, Viva voce. **Indirect:** student survey, Presentation
2.5	**Report** research findings in both written and verbal forms.	Individual and group discussion, report writing and presentation	**Direct** Written report, Viva voce. **Indirect:** student survey, Presentation
3.0	**Values**		
3.1	**Demonstrate** capacity to work both independently and in collaboration	Group discussion, group lab work	**Direct** (formative and summative): In lab

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
	with others to lead and manage the research work.		interactive questioning, write-ups, weekly journal entries, content quizzes, individual assignments **Indirect**: student survey, students to evaluation of their group's dynamics and their contributions in the project work.
3.2	**Practice** the skills, diligence, and commitment to excellence needed to engage in lifelong learning.	Interactive discussion- Case study, group assignment, open discussion - reviews	**Direct** (formative and summative): follow up of students Curiosity, resilience, reflection and initiative. **Indirect**: student survey
3.3	**Demonstrate** an awareness and application of appropriate personal, societal, and professional ethical standards.	Interactive discussion- Case study, group assignment, open discussion - reviews	**Direct** (formative and summative): follow up of the student' professional and ethical standards **Indirect**: student survey
3.4			
3.5			

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
	Supervisor:		
1	**Midterm Student Evaluation**	**7**	**20 (20%)**
2	**End-of-Project Evaluation**	**14**	**30 (30%)**
	Referee		
3	**Report**	**15**	**15 (15%)**
4	**Presentation**	**15**	**20 (20%)**
5	**Answering Questions**	**15**	**15 (15%)**
			100 (100%)

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice : **Each group of students is assigned to a staff member who will be available for help and**

academic guidance office hours at specific 2h on daily basis.

F. Learning Resources and Facilities

1. Learning Resources

Required Textbooks	To be find and chosen by students with the advising and help of the supervisor
Essential References Materials	To be find and chosen by students with the advising and help of the supervisor
Electronic Materials	Depends on the research topics
Other Learning Materials	Depends on the research topics

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	Room for interactive discussion (round table), Laboratories
Technology Resources (AV, data show, Smart Board, software, etc.)	Software, Data show, smart board, printer
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	Specific laboratory equipment if required by the supervisor. DSL.

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of teaching	Students, Peer and program leader	Indirect (CES)- Indirect peer evaluation
Assessment	Students, Program assessment committee.	Direct/ Indirect
Extent of achievement of course learning outcomes	URP coordinator	Direct/ Indirect
Quality of learning resources	Students, Faculty members	Indirect
Effectiveness of teaching	Students, Peer and program leader	Indirect (CES)- Indirect peer evaluation

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)
Evaluators (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

H. Specification Approval Data

Council / Committee	**Department council**
Reference No.	**8**
Date	**16/4/1442**